香港糖尿科護士協會
Association of Hong Kong Diabetes Nurses

The 15th AHKDN Annual Symposium and Annual General Meeting

24th June, 2023

Crystal Ballroom, 2/F, the Cityview Hotel,
23 Waterloo Road, Kowloon

精準醫學 掌握未來

Precision Medicine: From Diagnosis to Monitoring



The 15th AHKDN Annual Symposium

Update on Continuous Glucose Monitoring: From Detection to Guide Self-management

24 Jun 2023

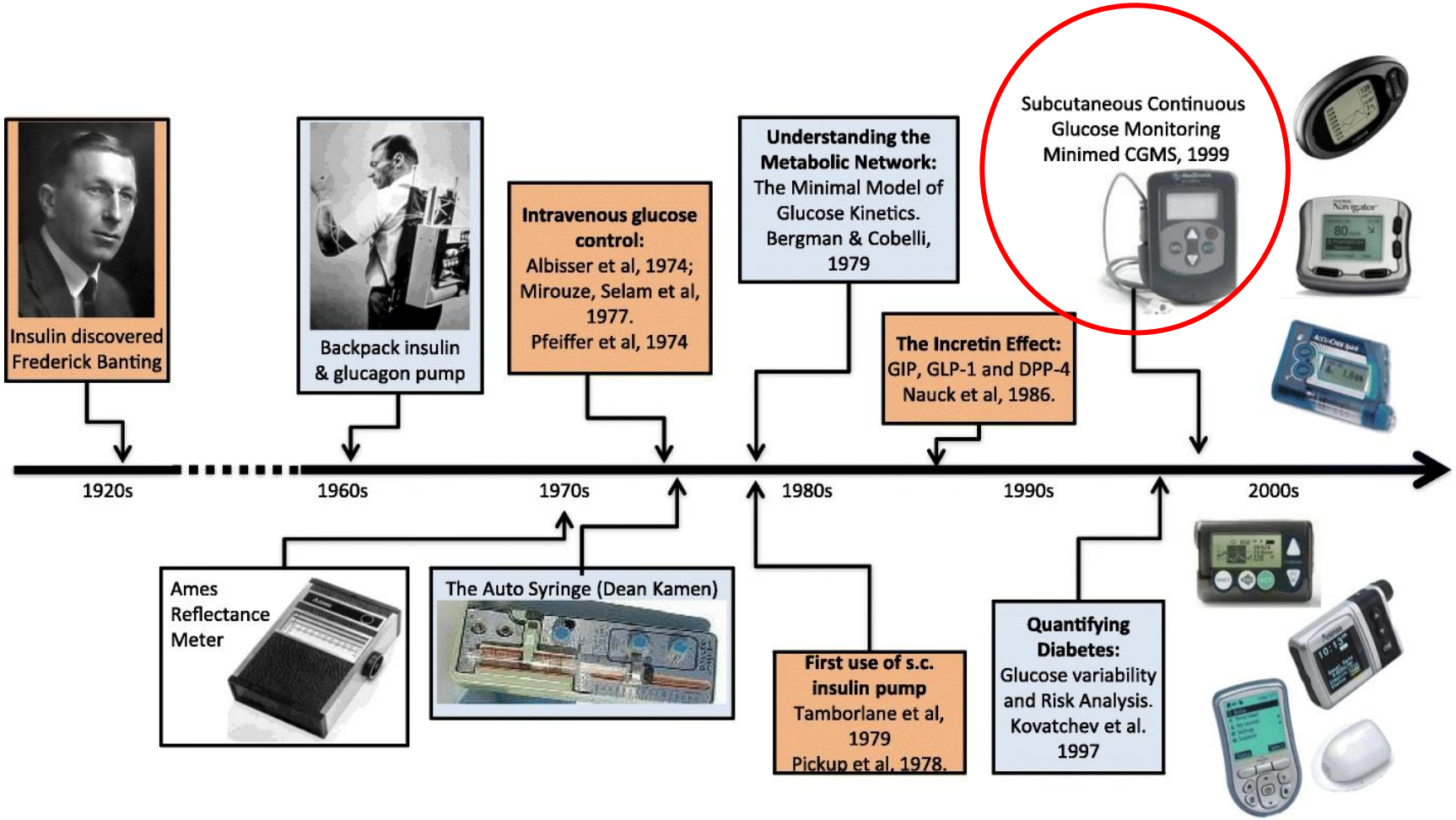
Anna Chui, Maisy Mok

Mabel Ng, Karen Wong,

Content

- Background of Continuous Glucose Monitoring (CGM)
- Libre CGM
- Dexcom CGM
- Guardian Connect CGM/Smart Insulin pen device
- Case Sharing

Continuous Glucose Monitoring (CGM) System since 1999



Timeline of diabetes technology development following the discovery of insulin in 1921
Kovatchev BP. Diabetes technology: monitoring, analytics, and optimal control.
Cold Spring Harb Perspect Med. 2018a. https://doi.org/10.1101/cshperspect.a034389.

CGM Systems Accuracy

MARD %: Mean Absolute Relative Differences

CGM readings vs Laboratory analyzer

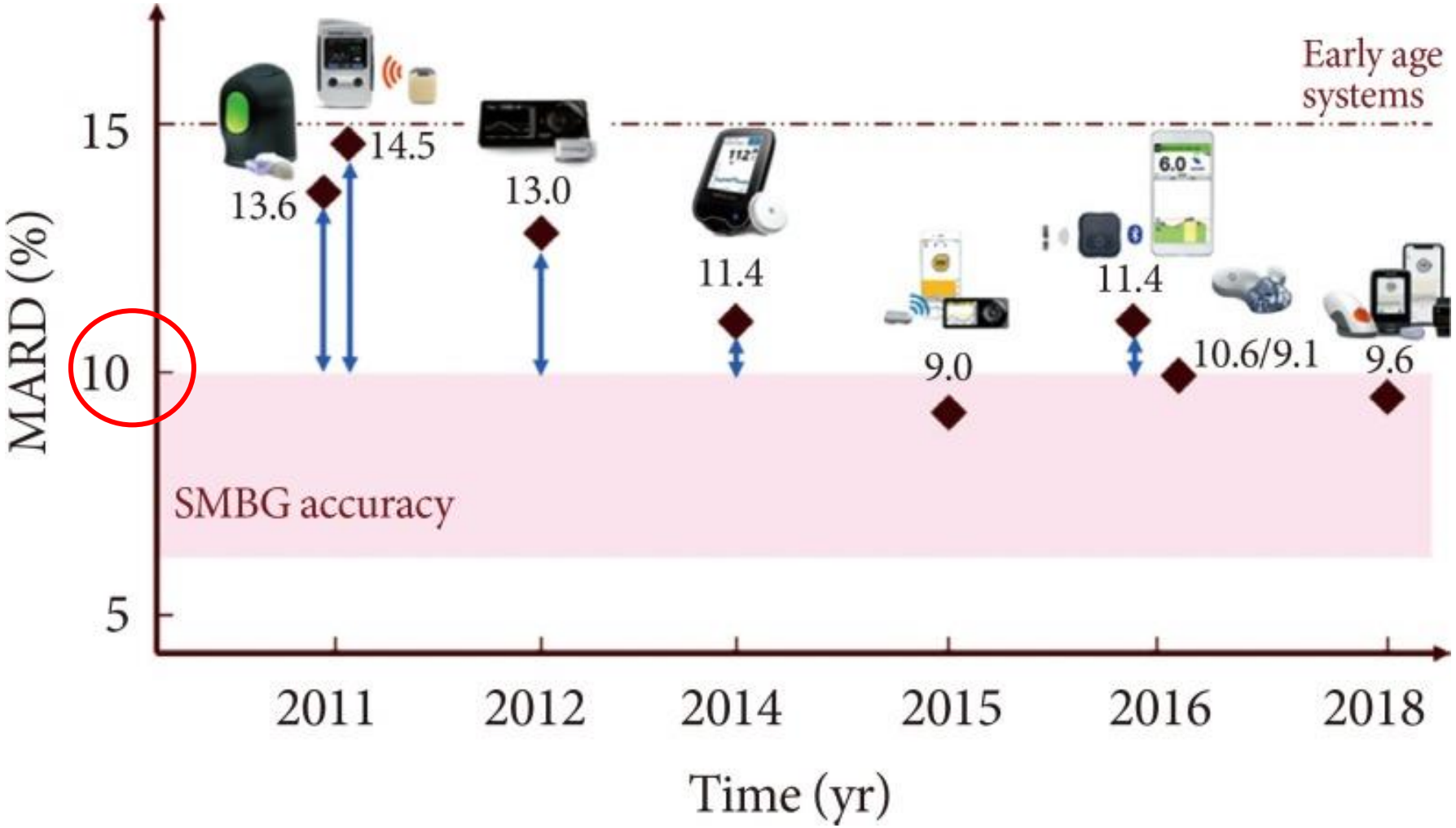


Fig. 2 Accuracy evolution of state-of-the-art CGM systems through years. From the left: Medtronic Enlite, Abbott Freestyle Navigator, Dexcom G4 Platinum, Abbott Freestyle Libre, Dexcom G4 Platinum with 505 software, Senseonics Eversense, Dexcom G5, Dexcom G6. MARD, mean absolute relative difference; SMBG, self-monitoring of blood glucose.

Cappon G., et al.Continuous Glucose Monitoring Sensors for Diabetes Management: A Review of Technologies and Applications, Diabetes & Metabolism Journal 2019;43(4):383-397. Published online: July 25, 2019 DOI: https://doi.org/10.4093/dmj.2019.0121

CGMS - Improvement in MARD accuracy

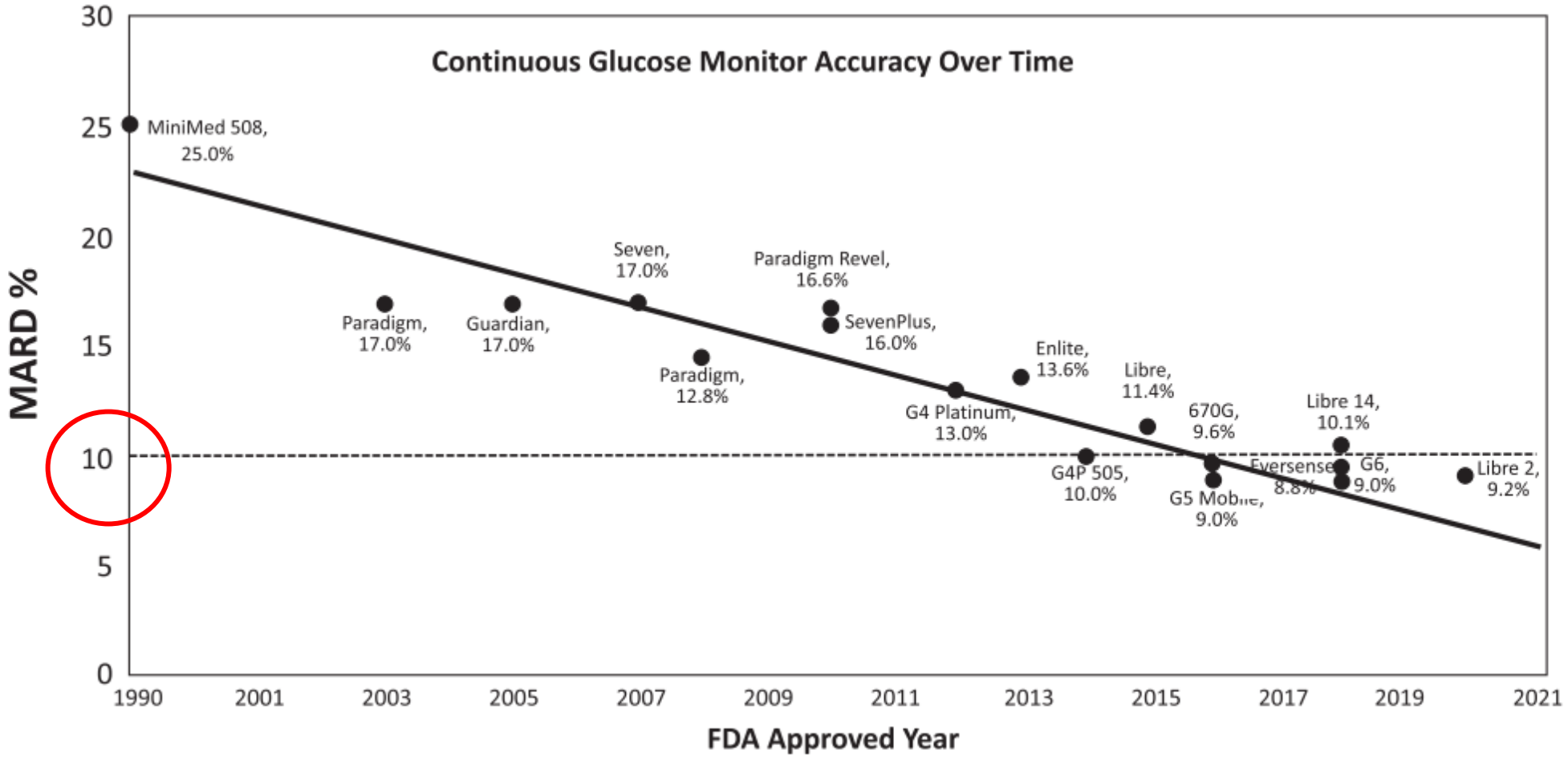


FIG. 1. Incremental improvements in MARD accuracy over the past 20 years. MARD, mean absolute relative difference.

Bailey & Alva (2021) Landscape of Continuous Glucose Monitoring (CGM) and Integrated CGM: Accuracy Considerations. DIABETES TECHNOLOGY & THERAPEUTICS Volume 23, Supplement 3, 2021 Mary Ann Liebert, Inc. DOI: 10.1089/dia.2021.0236

Evolution of Continuous Glucose Monitoring



Continuous Glucose Monitoring System:
Practice Guide for Diabetes Nurse

Project Leaders:
Mok Pik Hung, Maisy
Nurse Consultant, KEC
Wong Ka Chee, Karen
Nurse Consultant, HKWC

Project Members:
Chow Miu Fan
Advanced Practice Nurse, POH
Choy Wing Yee
Registered nurse, PWH
Lau Sau Lin, Tracy
Nurse Consultant, HKEC
Ng Mei Po, Mabel
Advanced Practice Nurse, UCH
Wong Yee Man, Rebecca
Nurse Consultant, NTEC

Project Advisor:
Winnie KW So
Associate Professor
The Nethersole School of Nursing
Faculty of Medicine
CUHK

Proof Reader:
Dr. Yeung Tok Fai, Vincent
Private Endocrinologist
Honorary Advisor
AHKDN

Version 1, Oct 2019

Expansion of Indications of CGM

- Freestyle Libre
- Dexcom G4/5
- iPro 2
- Guardian Connect 3

→

- Dexcom G6
- Obsoleted iPro 2

Different CGM reports → Standardized AGP reports

Association of Hong Kong Diabetes Nurses
Evidence-based Practice Project



Continuous Glucose Monitoring System:
Practice Guide for Diabetes Nurse 2nd Version

Project Leaders:
Mok Pik Hung, Maisy
Nurse Consultant, KEC
Wong Ka Chee, Karen
Nurse Consultant, HKWC

Project Members:
Chui On Lan, Anna
Advanced Practice Nurse, PMH
Ng Mei Po, Mabel
Associate Nurse Consultant, UCH
Chow Miu Fan
Associate Nurse Consultant, POH
Choy Wing Yee
Advanced Practice Nurse, PWH

Project Advisor:
Dr .Winnie KW So
Professor
The Nethersole School of Nursing
Faculty of Medicine
CUHK

Proof Reader:
Dr. Yeung Tok Fai, Vincent
Private Endocrinologist
Honorary Advisor
AHKDN

June 2022

Advances in Continuous Glucose Monitoring (CGM)







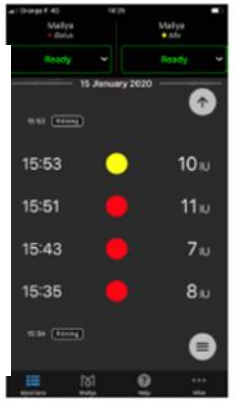




Smaller size
Water-proof
Longer days for testing 7-14 days
Realtime Glucose Monitoring/Alarm
Web cloud sharing
Use with / insulin pump/smart injection device





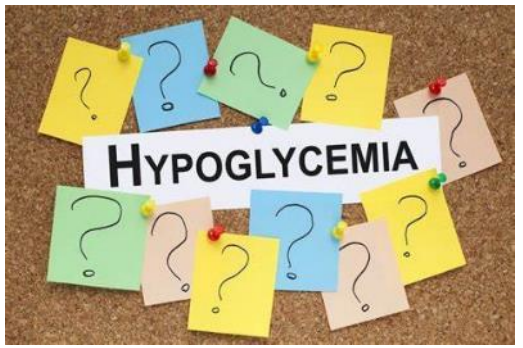


Evidence Based Practice of CGM



- As an adjunct or alternative to fingerstick blood glucose monitoring to diabetes management
- CGM has been shown to lower HbA1c, reduce glucose excursion, and minimize hypoglycemic frequencies
- Particularly useful in management of:
- insulin-treated patients
- hypoglycaemia (severe, frequent, nocturnal)
- hypoglycaemia unawareness
- sub-optimal glycaemic control
- during pregnancy

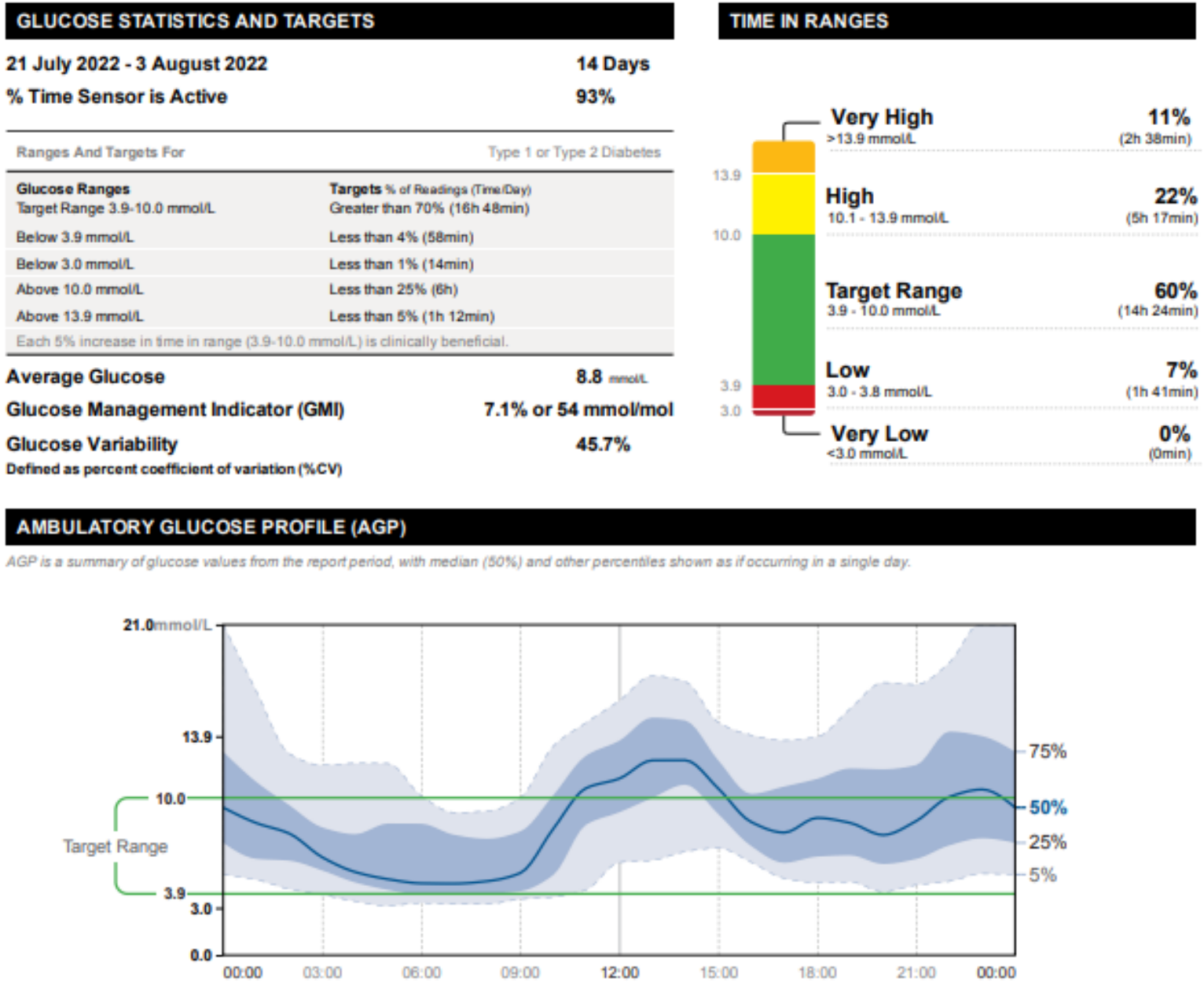




- HbA1c does not reflect hypo and Glucose Variability (GV)

Benefits of CGM Use

- Detailed information about time-in-range, glycaemic variability in a standardised ambulatory glucose profile to enhance clinical decision making.



GLUCOSE STATISTICS AND TARGETS

21 July 2022 - 3 August 2022	14 Days
% Time Sensor is Active	93%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)

Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose	8.8 mmol/L
Glucose Management Indicator (GMI)	7.1% or 54 mmol/mol
Glucose Variability Defined as percent coefficient of variation (%CV)	45.7%

TIME IN RANGES

Very High	>13.9 mmol/L	11% (2h 38min)
High	10.1 - 13.9 mmol/L	22% (5h 17min)
Target Range	3.9 - 10.0 mmol/L	60% (14h 24min)
Low	3.0 - 3.8 mmol/L	7% (1h 41min)
Very Low	<3.0 mmol/L	0% (0min)

13.9
10.0
3.9
3.0

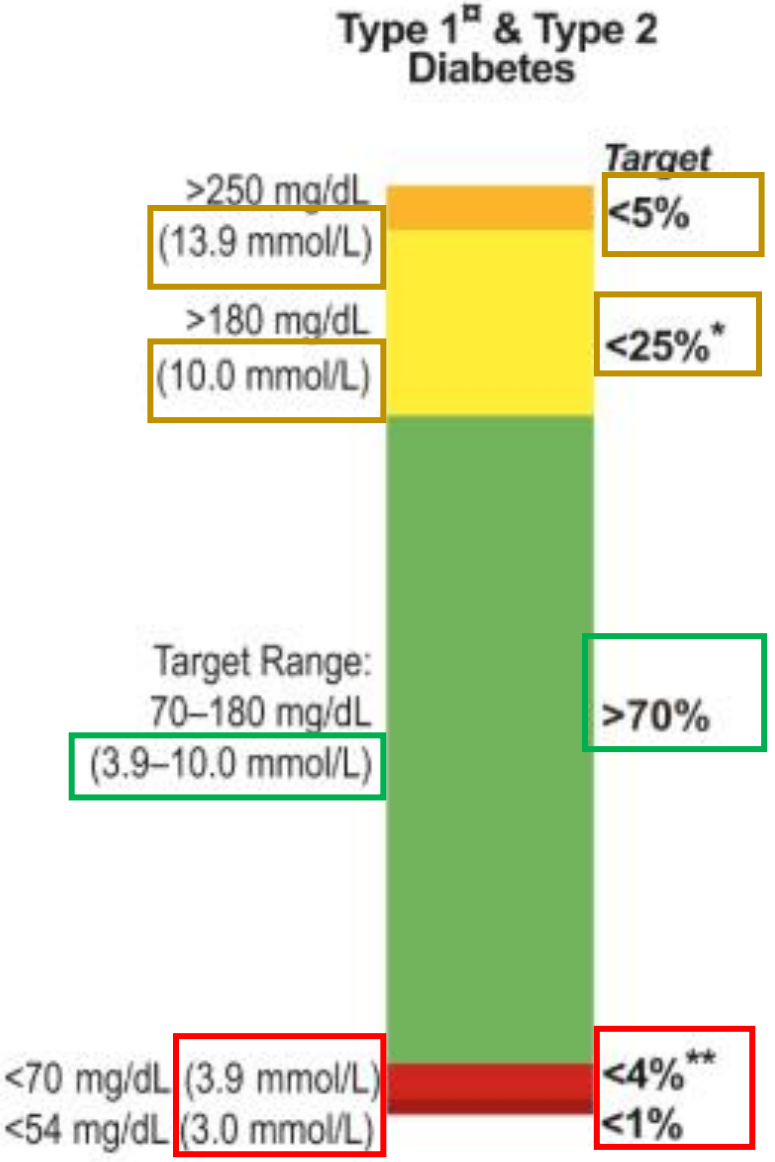
AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.

Time In Range- Type 1 & Type 2 DM

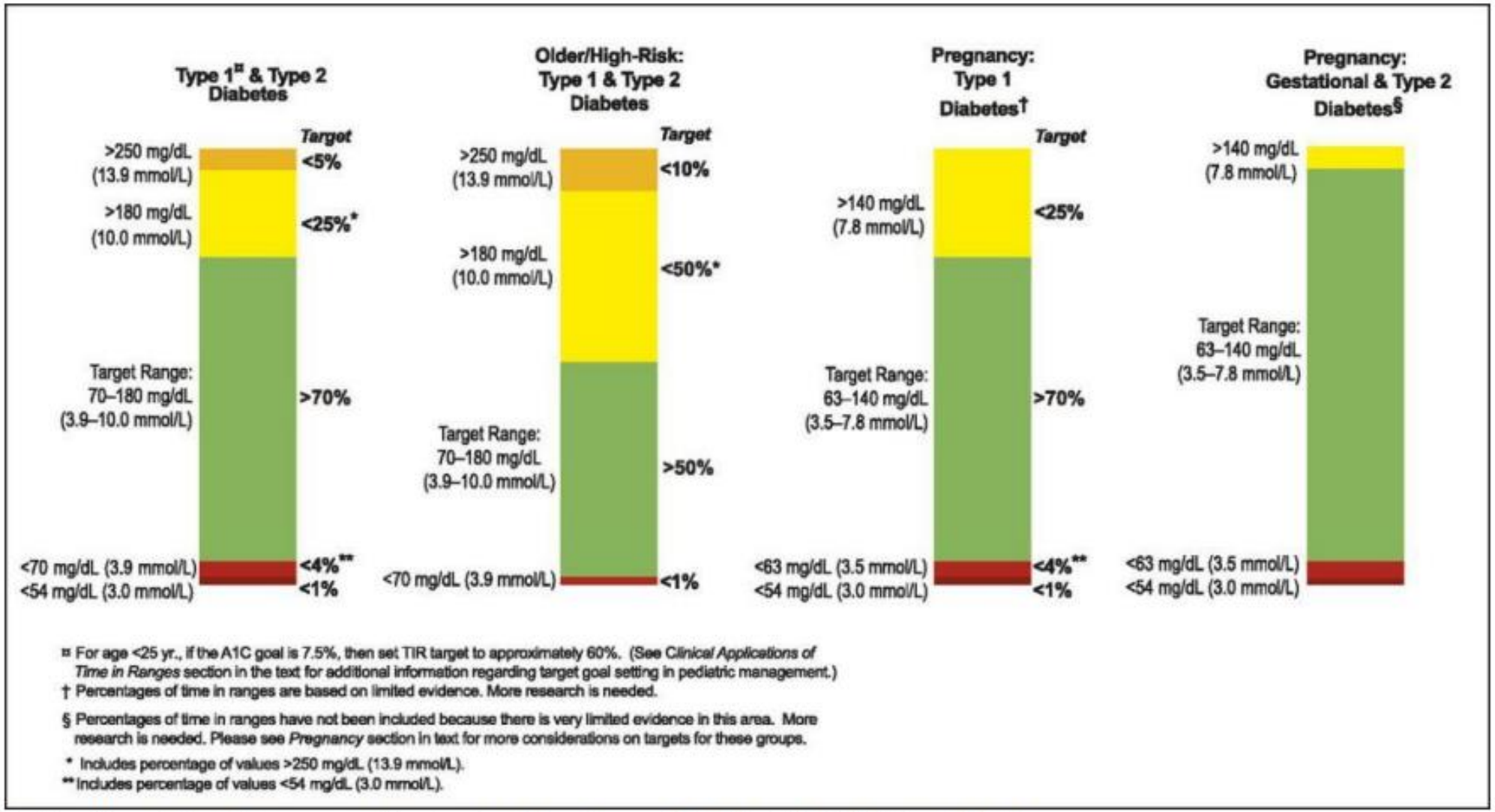
- Time Above Range TAR (> 10.0 mmol/L)
- < 30%
- Time In Range TIR (3.9-10.0 mmol/L)
- > 70%
- Time Below Range TBR < 3.9 mmol/L
- < 5%

- Every 10% increase in Time In Range
  = ~0.8% decrease in HbA1c



Vigersky & McMahon, 2019, The relationship of Hemoglobin A1c to time-in-range in patients diabetes, Diabetes Technol Ther 21(2)81-85

CGM-based targets for different diabetes populations



¤ For age <25 yr., if the A1C goal is 7.5%, then set TIR target to approximately 60%. (See *Clinical Applications of Time in Ranges* section in the text for additional information regarding target goal setting in pediatric management.)

† Percentages of time in ranges are based on limited evidence. More research is needed.

§ Percentages of time in ranges have not been included because there is very limited evidence in this area. More research is needed. Please see *Pregnancy* section in text for more considerations on targets for these groups.

* Includes percentage of values >250 mg/dL (13.9 mmol/L).

** Includes percentage of values <54 mg/dL (3.0 mmol/L).

Battelino T. & Danne T et al. Dia Care 2019;42:1593-1603

Standardized One Page Summary-CGM Report

Tak Ling Chan
DOB: 04/04/1964
MRN:
DEVICE: FreeStyle LibreLink +
QMH DMC
PHONE: 22553780
PAGE: 1 / 1
Generated: 27/10/2022

AGP Report

21 July 2022 - 3 August 2022 (14 Days)

LibreView

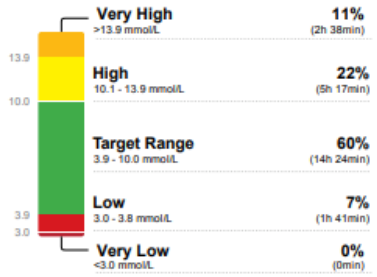
GLUCOSE STATISTICS AND TARGETS

21 July 2022 - 3 August 2022	14 Days
% Time Sensor is Active	93%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

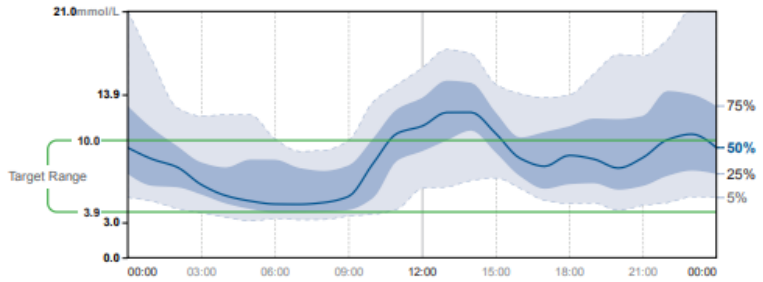
Average Glucose	8.8 mmol/L
Glucose Management Indicator (GMI)	7.1% or 54 mmol/mol
Glucose Variability	45.7%
Defined as percent coefficient of variation (%CV)	

TIME IN RANGES



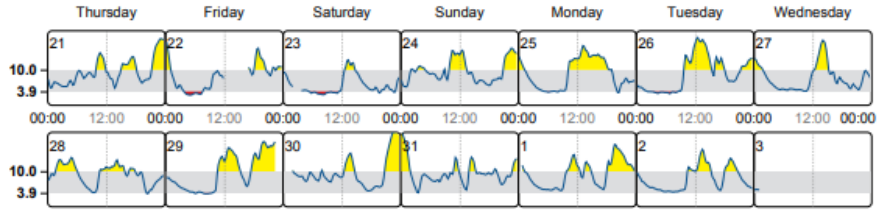
AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



DAILY GLUCOSE PROFILES

Each daily profile represents a midnight to midnight period with the date displayed in the top-left corner.



Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetes Association, 7 June 2019, https://doi.org/10.2337/dci19-0028.

Tak Ling Chan DOB: 04/04/1964

Glucose Pattern Insights

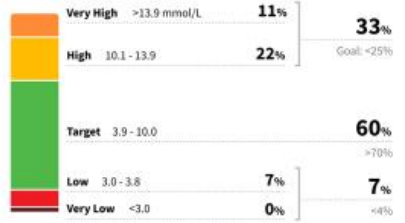
LibreView

Generated: 27/10/2022 Page: 1 of 1

Selected dates: 21 Jul - 3 Aug 2022 (14 Days)

Time sensor active: 93%

Time in Ranges



Glucose Statistics

Average Glucose

8.8 mmol/L Goal: ≤8.6 mmol/L

Glucose Management Indicator (GMI)

Approximate A1C level based on average CGM glucose level.

7.1% Goal: ≤7.0% | 54 mmol/mol Goal: ≤53 mmol/mol

Considerations for the Clinician[1]

Most Important Pattern: Lows Overnight, Morning

Medication

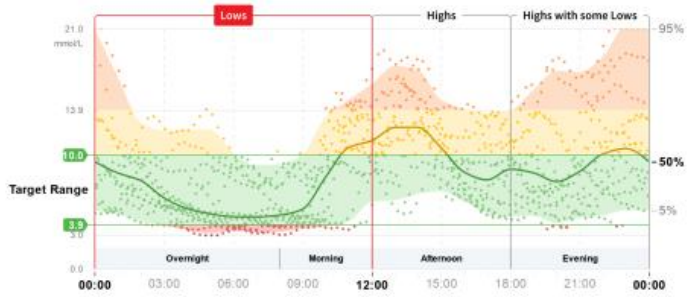
- Medications contributing to lows?
- Medication added to address highs may worsen lows

Lifestyle

Lows are often associated with high glucose variability. The following behaviours may contribute to glucose variability:

- Meals sometimes missed or vary in carbohydrates?
- Activity level varies daily?
- Alcohol consumption varies daily?

Glucose Patterns (14 Days)



Device(s): FreeStyle LibreLink +

1. Suggested considerations do not replace the opinion or advice of the healthcare provider.

Benefits of CGM Use

- Clinical benefits for therapy adjustment e.g. insulin dose adjustment
- Better understanding of how diet, exercise and lifestyle impact on their glucose control
- Educate and empower patient to modify health behaviour and subsequently improve self-management to prevent hypo- and hyperglycaemia.



Benefits of CGM Use

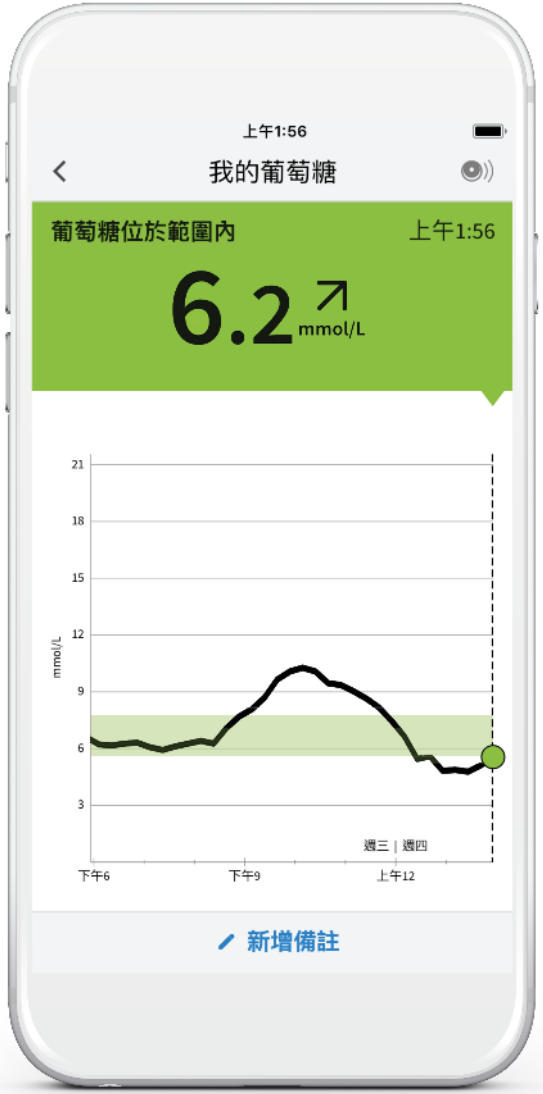
- Enhance communication with healthcare professionals, family members and care takers through data sharing.

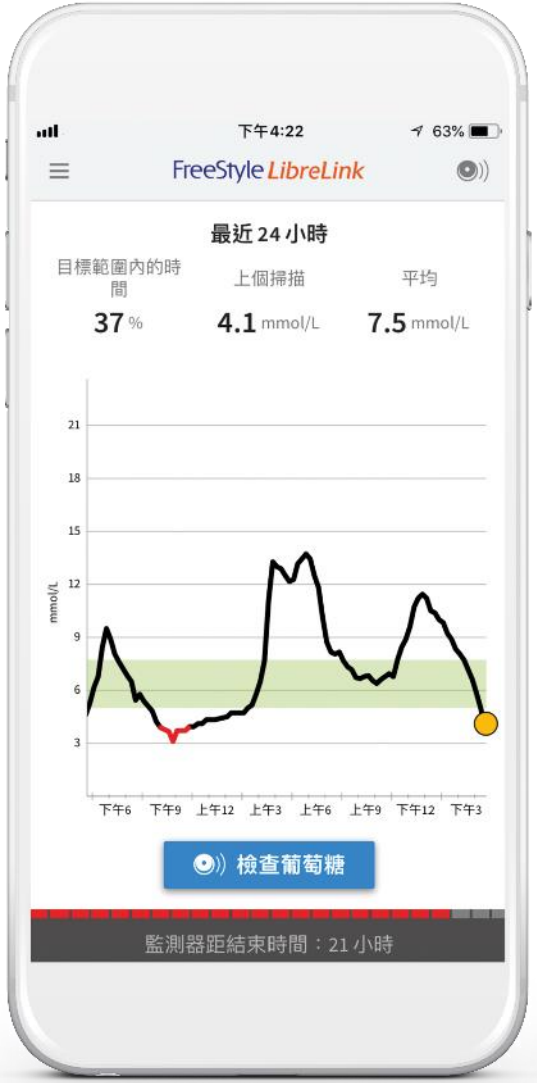
- CGM could be a significant platform to enhance diabetes tele-health care services to connect with patients remotely

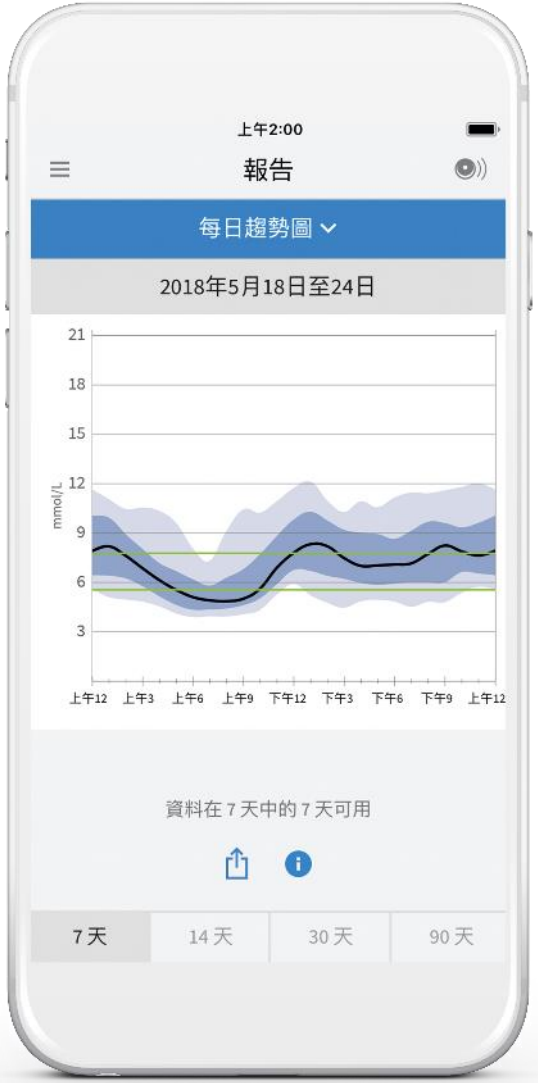


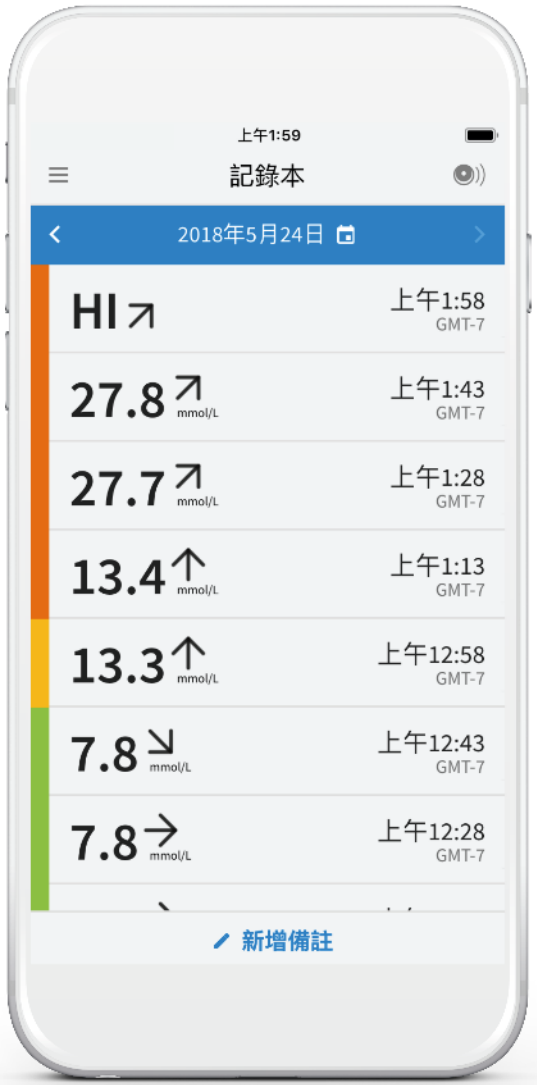
LibreLink Mobile App










上午1:59
記錄本
2018年5月24日
HI
上午1:58
GMT-7
27.8 mmol/L
上午1:43
GMT-7
27.7 mmol/L
上午1:28
GMT-7
13.4 mmol/L
上午1:13
GMT-7
13.3 mmol/L
上午12:58
GMT-7
7.8 mmol/L
上午12:43
GMT-7
7.8 mmol/L
上午12:28
GMT-7
新增備註


下午1:46
98%
報告
平均葡萄糖
2019年1月29日 至 4月28日
8.8
7.2
6.3
7.0
8.9
8.4
8.7
8.9
上午12 上午3 上午6 上午9 下午12 下午3 下午6 下午9 上午12
平均： 8.0 mmol/L
資料在 90 天中的 29 天可用
7 天
14 天
30 天
90 天


上午11:51
90%
報告
目標範圍內的時間
2019年3月28日 至 4月26日
mmol/L
> 13.3 3%
7.8-13.3 38%
5.0-7.7 40%
3.9-4.9 14%
< 3.9 5%
目標範圍： 5.0 - 7.7 mmol/L
資料在 30 天中的 28 天可用
7 天
14 天
30 天
90 天


報告
低葡萄糖事件
2019年3月28日至4月26日
0
1
0
0
2
1
0
1
上午12 上午3 上午6 上午9 下午12 下午3 下午6 下午9 上午12
總事件數： 5
資料在 30 天中的 18 天可用
7 天
14 天
30 天
90 天


上午1:56
我的葡萄糖
葡萄糖位於範圍內
上午1:56
6.2
mmol/L
21
18
15
12
9
6
3
mmol/L
週三 | 週四
下午6
下午9
上午12
新增備註


10:15
LTE
取消
編輯時間
完成
8
9
上午 10
下午 11
12
13
14
15
16
17


新增備註
備註
6月16日 週五
上午10:00
食物
餐別
份碳水化合物
速效胰島素
單位
長效胰島素
單位
運動
選擇強度
0 小時 0 分鐘
註釋
取消
完成


新增備註
備註
6月9日 週五
上午10:15
食物
餐別
早餐
午餐
晚餐
點心
份碳水化合物
速效胰島素
長效胰島素
運動
註釋
取消
完成

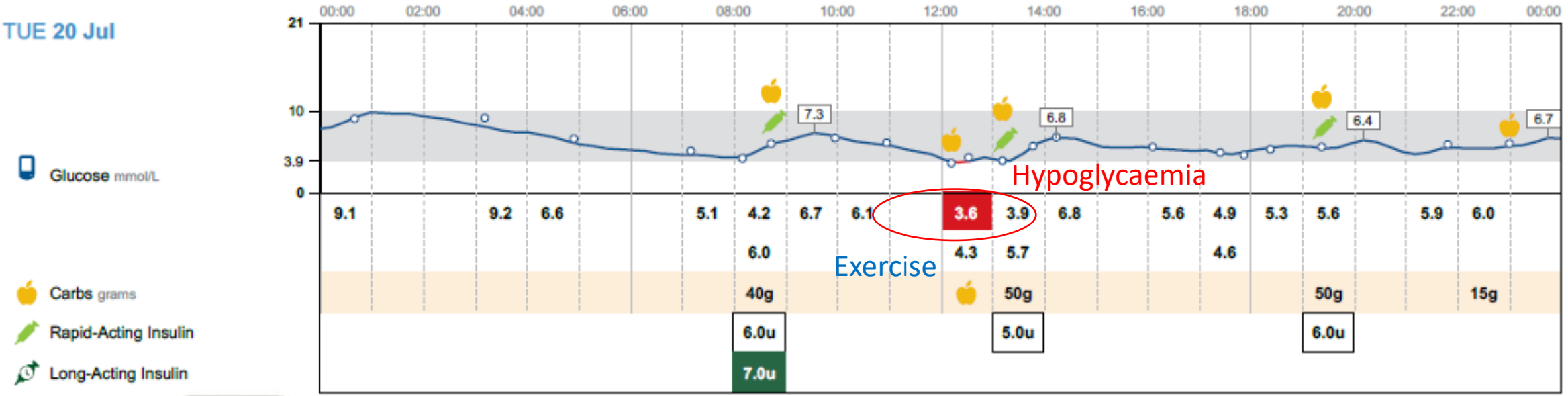
Daily glucose profile and activities

Daily Log

16 July 2021 - 29 July 2021 (14 Days)

LibreView

TUE 20 Jul

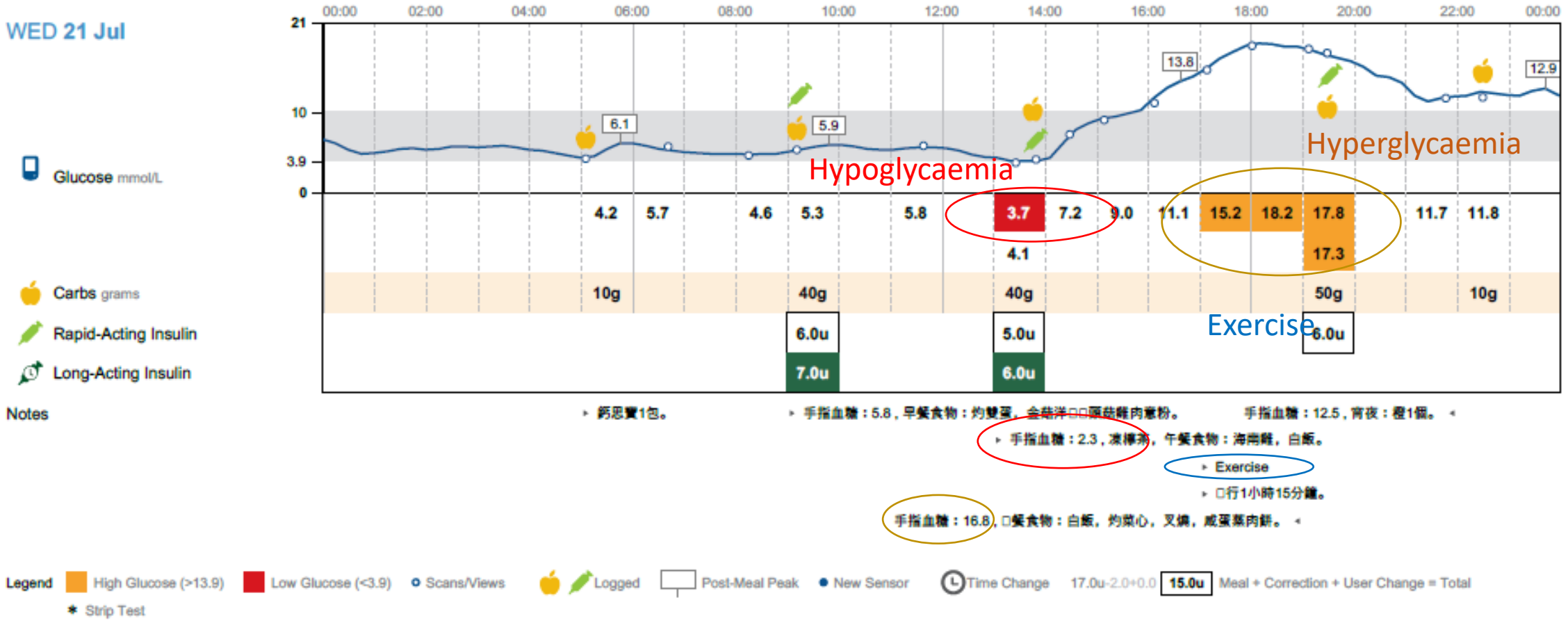


Notes



- 手指血糖：6.7，早餐食物：鈣思寶麥皮，灼雙蛋。
- 手指血糖：6.4，宵夜：橙1個，古早蛋糕。
- Exercise
- 果汁200毫升。
- 30分鐘健身單車，35分鐘划艇機，運動前吃了23克餅乾。
- 手指血糖：3.3，鈣思寶1包，午餐食物：糙米飯，蜜糖雞中翼，洋□節瓜湯，杞子菜心素腐竹，鮮搾橙汁。
- 指血糖：5.6，□餐食物：白飯，油雞，椰菜，灼小棠菜，咸蛋蒸肉餅。

Daily Glucose Profile and Activities



DOB: 21/09/1960

Case 1 - Ms Wu

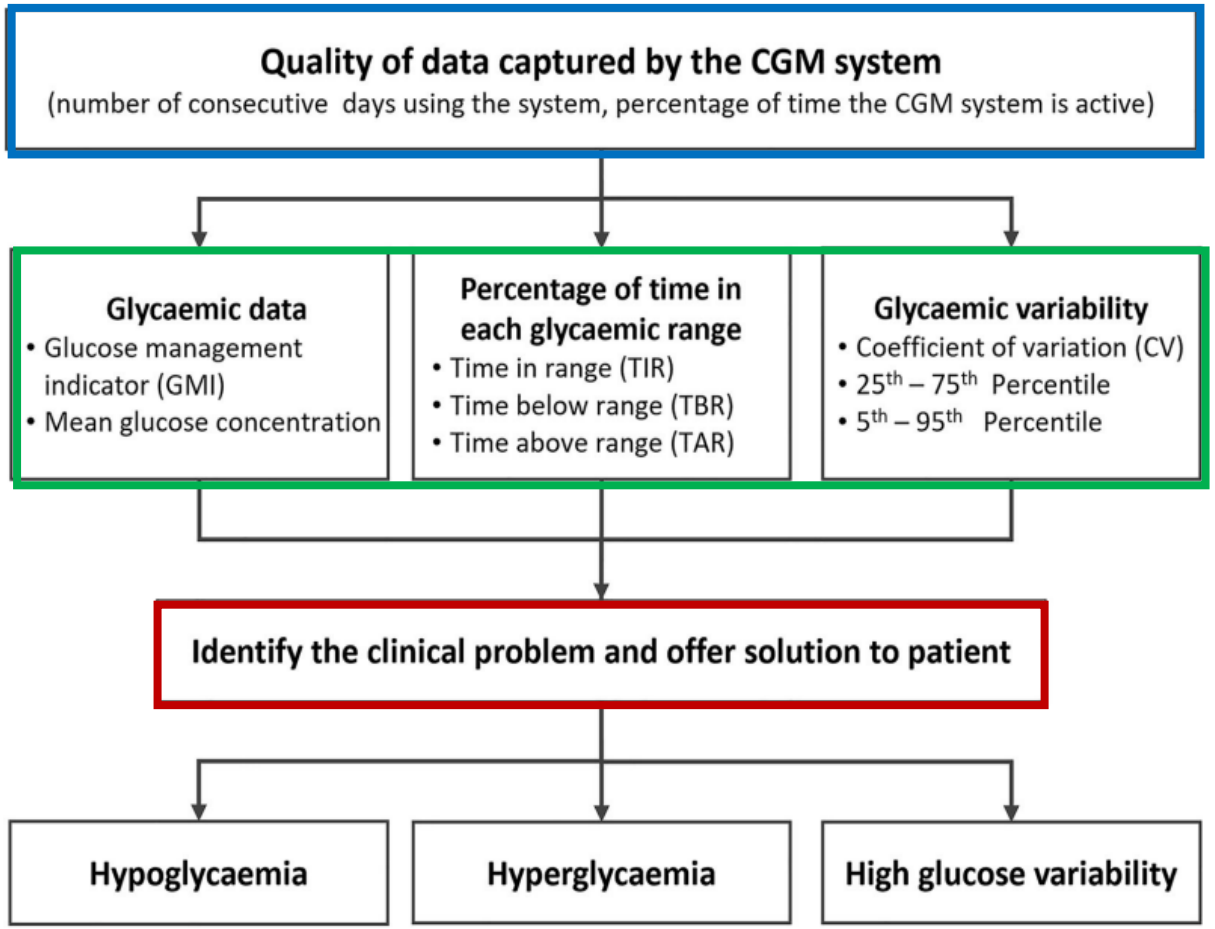
- Type 1 DM for 20 years
- F/ 52; Housewife
- On basal bolus insulin (MDI)
- Novorapid 6/6/6 units SC TDS; Tresiba 12 units SC Nocte
- HbA1c 6.9%
- SMBG with fluctuating blood glucose
- Occasional hypo pre-meal, post-meal glucose up to 12-15 mmol/L
- Occasional mid-night hunger
- Referred for CGM monitoring

Algorithm for Assessment and Interpretation of AGP Report

Step 1

Step 2

Step 3



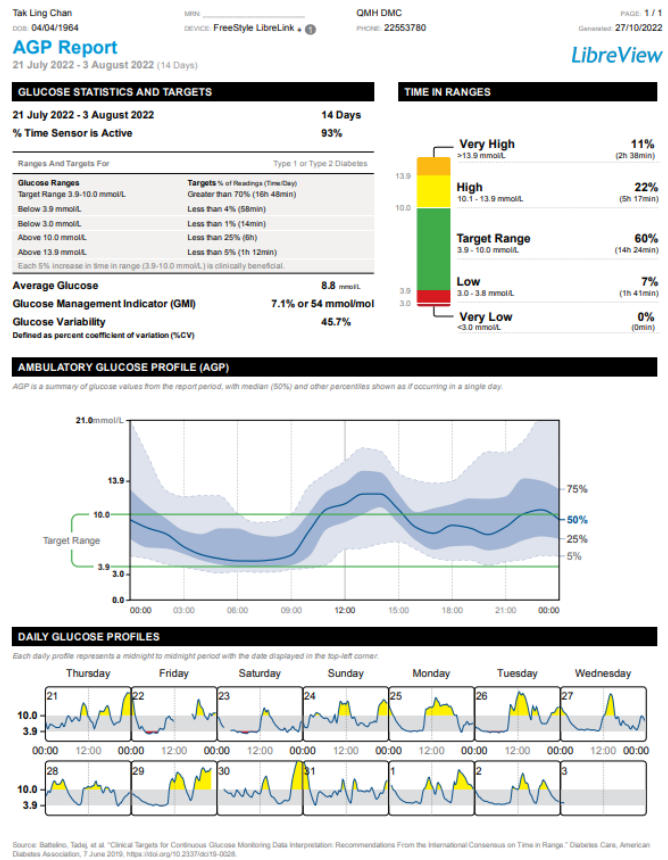
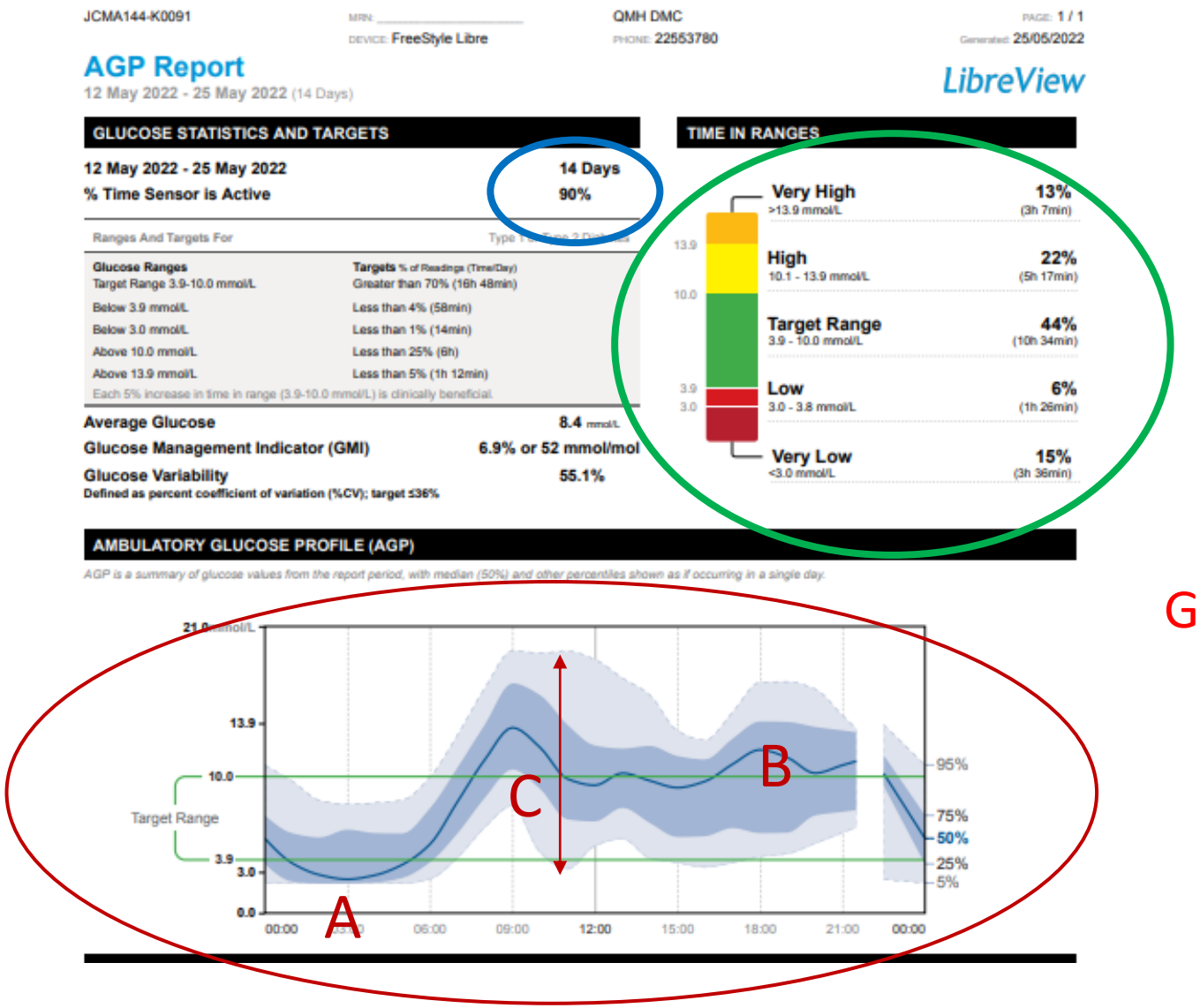


Fig. 2 Algorithm for the assessment and interpretation of an AGP report. This simple algorithm illustrates the flow of activities that should be followed when interpreting an AGP report, starting at the top with an assessment of the data quality. *AGP* ambulatory glucose profile, *CGM* continuous glucose monitoring

- *Cuppano, L. et al (2022) Ambulatory Glucose Profile (AGP) Report in Daily Care of Patients with Diabetes: Practical Tips and Recommendations, Diabetes Therapy* ***volume 13****, pages811–821 (2022) p. 818*

Ms Wu AGP report


JCMA144-K0091 MRN: _____ DEVICE: FreeStyle Libre QMH DMC PHONE: 22553780 PAGE: 1 / 1 Generated: 25/05/2022

AGP Report

12 May 2022 - 25 May 2022 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

12 May 2022 - 25 May 2022	14 Days
% Time Sensor is Active	90%

Ranges And Targets For Type 1 Type 2 Diabetes

Glucose Ranges	Targets % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)

Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose	8.4 mmol/L
Glucose Management Indicator (GMI)	6.9% or 52 mmol/mol
Glucose Variability	55.1%

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES

Very High	>13.9 mmol/L	13% (3h 7min)
High	10.1 - 13.9 mmol/L	22% (5h 17min)
Target Range	3.9 - 10.0 mmol/L	44% (10h 34min)
Low	3.0 - 3.8 mmol/L	6% (1h 26min)
Very Low	<3.0 mmol/L	15% (3h 36min)

AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.

1. Check Data Sufficiency:

- 70% of the expected values
- (>10 out of 14 day)

(Ms Wu: used 14 days with 90%)

2. Assess TIR, TAR and TBR

(Ms Wu: **TIR: 44%;** TAR 35%; TBR 21%)

Target of TIR >70% (T1 patients)

Average Glucose 8.4 mmol/L

Glucose Management Index GMI 6.9%

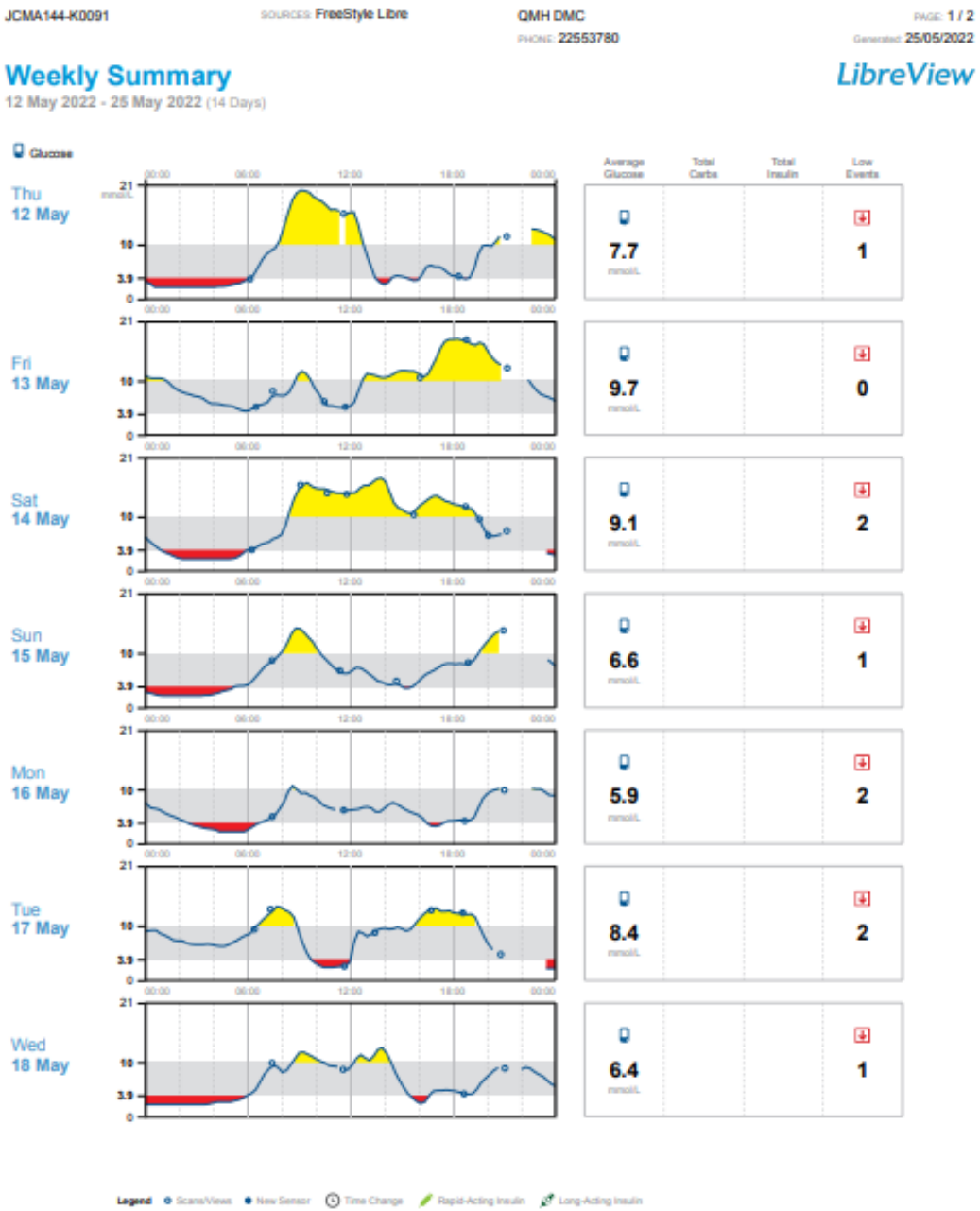
Glucose Variability 55.1% vs (HbA1c 6.9%)

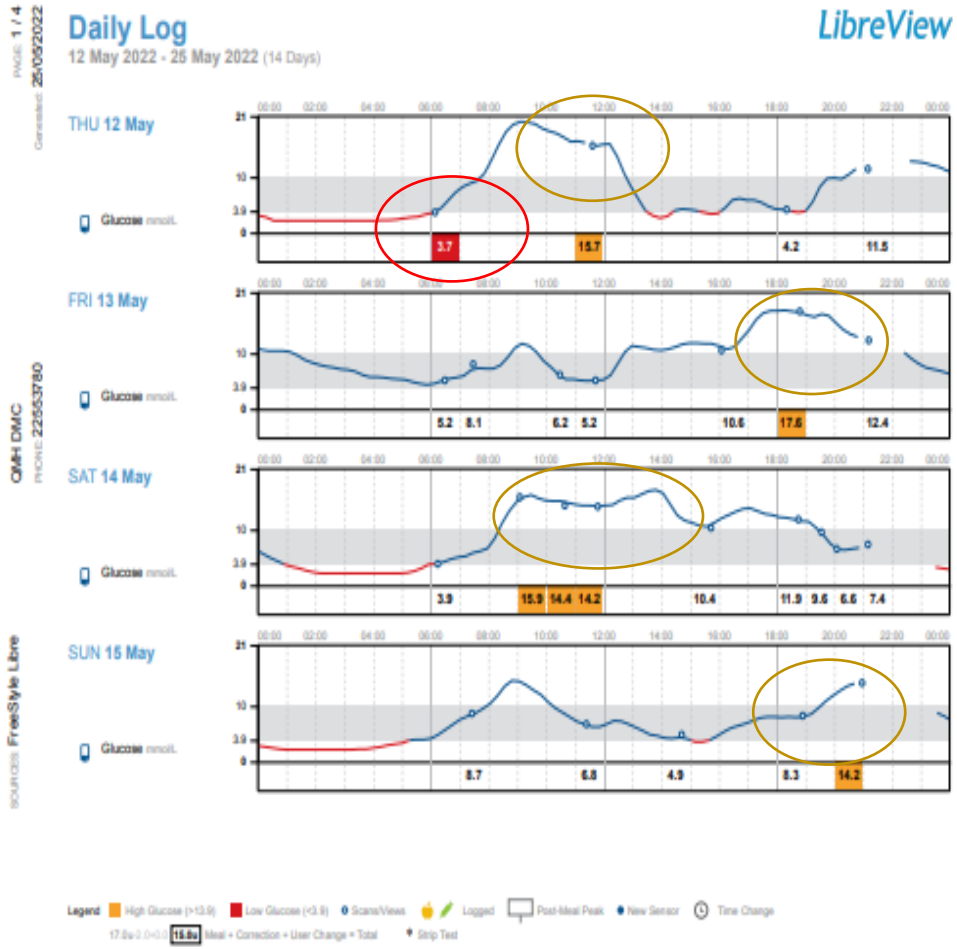
3. Review Ambulatory Glucose Profile (AGP)

i) Check for Hypoglycaemia/Hyperglycaemia

ii) look at median curve vs target glucose range

iii) observe daily fluctuations in glucose level

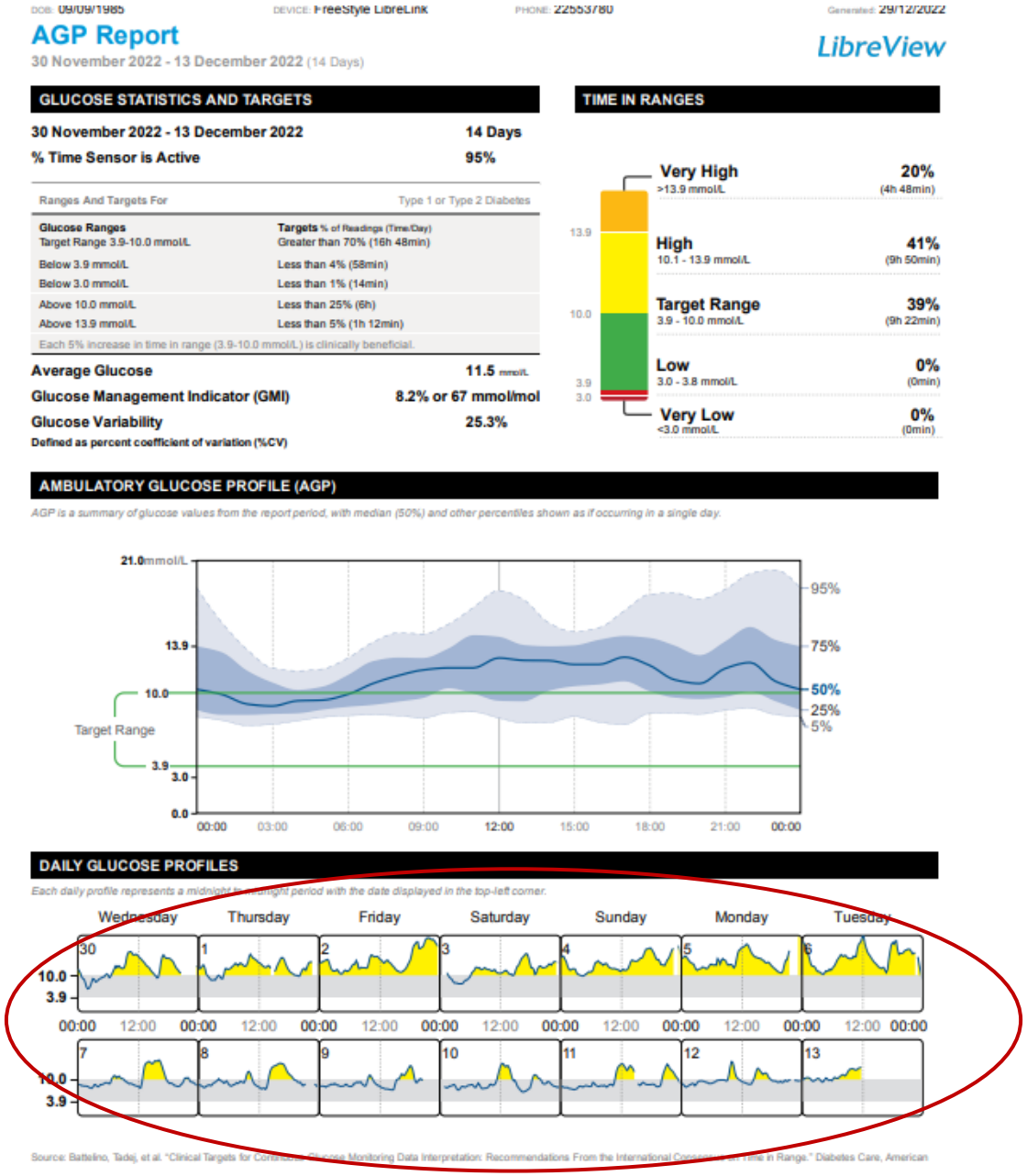




- **Identify Problems and Offer Solution**
- Frequent Nocturnal hypo, with unawareness
- Occasional hypo day-time, might due to increase physical activity
- Inconsistent CHO intake → Hypo/ post-prandial hyperglycaemia
- Decrease basal insulin, night snack
- Reinforce proper hypo treatment
- CHO counting with fine adjustment of prandial nsulin

Case 2 - Mr Dan

- Type 2 DM since 2021
- HT, Hyperlipidaemia
- BW 76.8 kg BH 1.69m BMI 26.89
- M/ 37; Account manager
- Sedentary lifestyle, no exercise, always dining out
- Referral from private doctor to SOPC DM new case FU
- On Glyxambi(Empagliflozin + Linagliptin) 25/5mg Daily & Metformin XR 500mg Daily
- FBS 8.9 mmol/L, HbA1c 8.2%, eGFR 122 (8 Nov 2022)



DOB: 09/09/1985 DEVICE: FreeStyle LibreLink PHONE: 22553780 Generated: 29/12/2022

AGP Report

30 November 2022 - 13 December 2022 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

30 November 2022 - 13 December 2022	14 Days
% Time Sensor is Active	95%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)

Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose	11.5 mmol/L
Glucose Management Indicator (GMI)	8.2% or 67 mmol/mol
Glucose Variability	25.3%

Defined as percent coefficient of variation (%CV)

TIME IN RANGES

Very High	>13.9 mmol/L	20% (4h 48min)
High	10.1 - 13.9 mmol/L	41% (9h 50min)
Target Range	3.9 - 10.0 mmol/L	39% (9h 22min)
Low	3.0 - 3.8 mmol/L	0% (0min)
Very Low	<3.0 mmol/L	0% (0min)

13.9 10.0 3.9 3.0

AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.

21.0 mmol/L
13.9
10.0
Target Range
3.9
3.0
0.0
00:00 03:00 06:00 09:00 12:00 15:00 18:00 21:00 00:00
95%
75%
50%
25%
5%

DAILY GLUCOSE PROFILES

Each daily profile represents a midnight to midnight period with the date displayed in the top-left corner.

Wednesday Thursday Friday Saturday Sunday Monday Tuesday
30 1 2 3 4 5 6
10.0
3.9
00:00 12:00 00:00 12:00 00:00 12:00 00:00 12:00 00:00 12:00 00:00 12:00 00:00 12:00 00:00
7 8 9 10 11 12 13
10.0
3.9

Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American

Mr Dan

FU DM Clinic New Case on 18 Nov 2022

Off Glyxambi and Metformin XR
Put on Metformin 1gm BD and Alogliptin 25mg Daily

Advised on glucose monitoring and patient self-put on CGM

CGM done 30 Nov -13 Dec 2022
14 Days readings; 95% Time sensor is Active

TAR 61%; **TIR 39%;**TBR 0% (Target > 70%)
(>13.9mmol/L: 20%; 10.1-13.9 mmol/L: 41%)
Average Glucose 11.5 mmol/L
GMI 8.2%; Glucose Variability 25.3%

Patient aware of highish glucose, try effort in diet control
Improved profile in 2nd week

DOB: 09/09/1985 DEVICE: FreeStyle LibreLink PHONE: 22553780 Generated: 29/12/2022

AGP Report

16 December 2022 - 29 December 2022 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

16 December 2022 - 29 December 2022	14 Days
% Time Sensor is Active	89%

Ranges And Targets For: Type 1 or Type 2 Diabetes

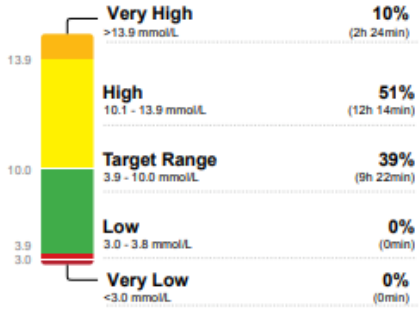
Glucose Ranges	Targets % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)

Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose	10.9 mmol/L
Glucose Management Indicator (GMI)	8.0% or 64 mmol/mol
Glucose Variability	20.6%

Defined as percent coefficient of variation (%CV)

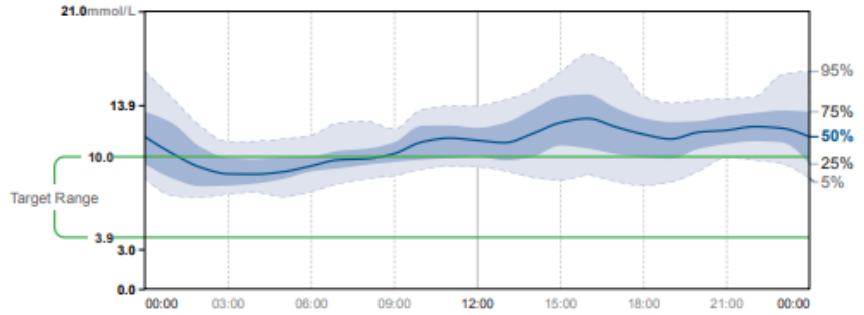
TIME IN RANGES



Very High	>13.9 mmol/L	10% (2h 24min)
High	10.1 - 13.9 mmol/L	51% (12h 14min)
Target Range	3.9 - 10.0 mmol/L	39% (9h 22min)
Low	3.0 - 3.8 mmol/L	0% (0min)
Very Low	<3.0 mmol/L	0% (0min)

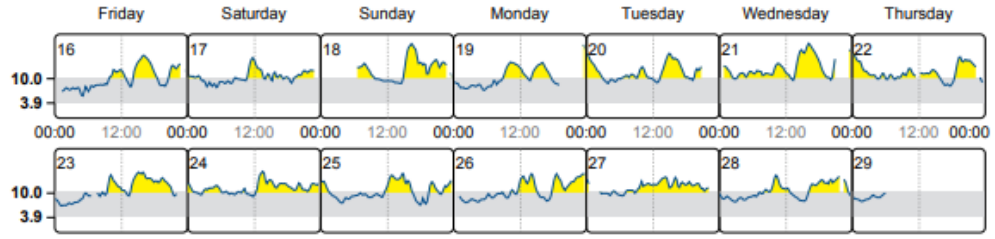
AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



DAILY GLUCOSE PROFILES

Each daily profile represents a midnight to midnight period with the date displayed in the top-left corner.



Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetes Association, 7 June 2019, https://doi.org/10.2337/dci19-0028.

Case - Mr Dan

1st DM Nurse Visit on 29 Dec 2022 (2 weeks later)

CGM 16-29 Dec 2022

14 Days readings; 89% Time sensor is Active

TAR 61%; **TIR 39%**;TBR 0% **(SAME)** (Target > 70%)

(>13.9mmol/L: 20% → 10%; 10.1-13.9 mmol/L: 41% → 51%)

Average glucose 11.5→ 10.9 mmol/L

GMI 8.2% → 8.0% GV 25.3 → 20.6%

Problem:

-Poor drug compliance

-only taking Metformin 1gm pm instead of BD

-Fair diet control as dining out

-Lack of exercise

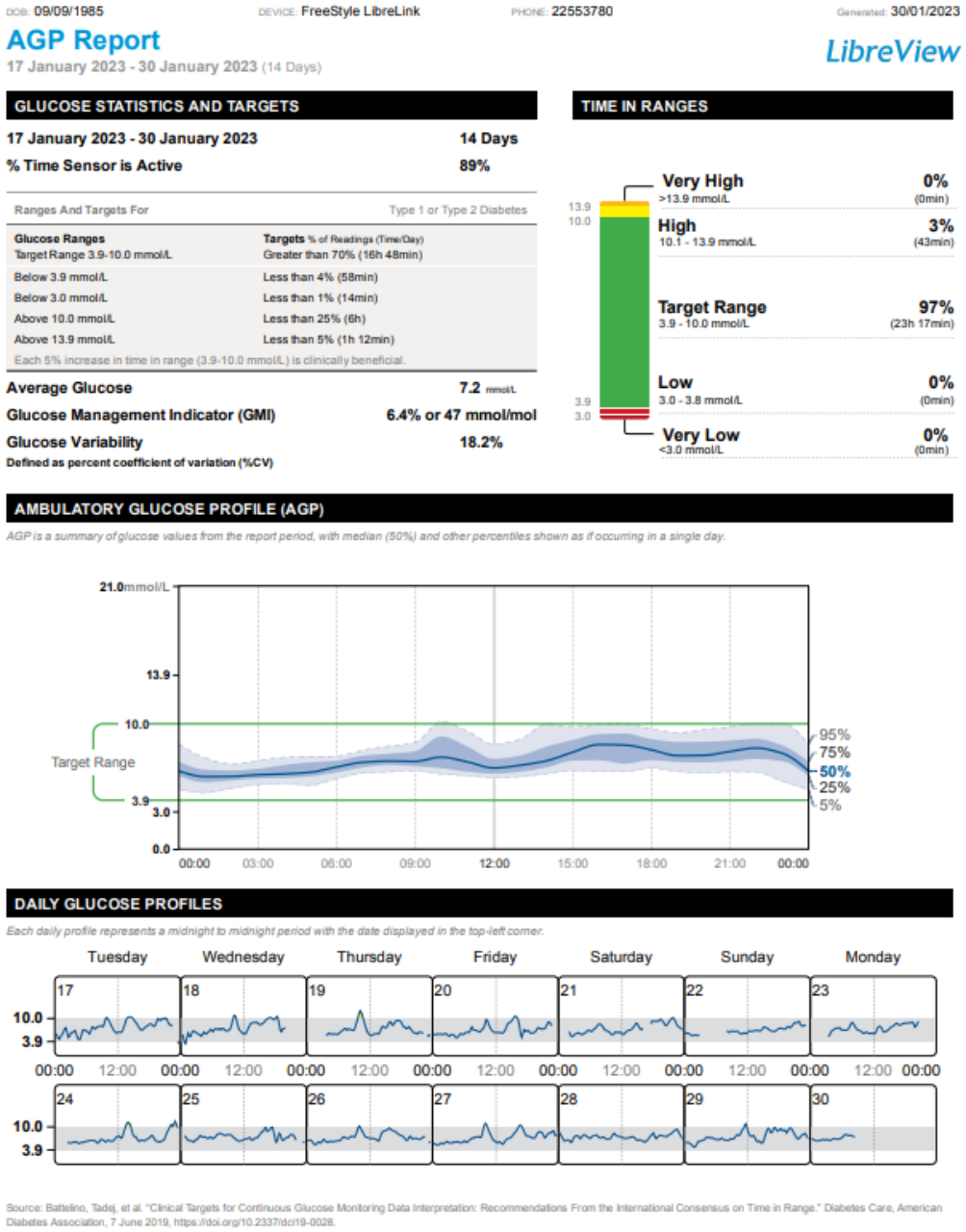
Management:

-Discussed with patient for CGM report; educate and empower patient on lifestyle change and drug adherence

- Resumed Metformin 1gm BD

–Declined SFI GLP-1 RA; resume SFI Empagliflozin 25 mg daily

- Continue CGM; reminded proper scanning to review glucose



DOB: 09/09/1985 DEVICE: FreeStyle LibreLink PHONE: 22553780 Generated: 30/01/2023

AGP Report

17 January 2023 - 30 January 2023 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

17 January 2023 - 30 January 2023	14 Days
% Time Sensor is Active	89%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges Target Range 3.9-10.0 mmol/L	**Targets** % of Readings (Time/Day) Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)

Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose	7.2 mmol/L
Glucose Management Indicator (GMI)	6.4% or 47 mmol/mol
Glucose Variability	18.2%

Defined as percent coefficient of variation (%CV)

TIME IN RANGES

13.9
10.0
3.9
3.0

Very High	>13.9 mmol/L	0% (0min)
High	10.1 - 13.9 mmol/L	3% (43min)
Target Range	3.9 - 10.0 mmol/L	97% (23h 17min)
Low	3.0 - 3.8 mmol/L	0% (0min)
Very Low	<3.0 mmol/L	0% (0min)

AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.

21.0mmol/L
13.9
10.0
Target Range
3.9
3.0
0.0
00:00 03:00 06:00 09:00 12:00 15:00 18:00 21:00 00:00
95%
75%
50%
25%
5%

DAILY GLUCOSE PROFILES

Each daily profile represents a midnight to midnight period with the date displayed in the top-left corner.

Tuesday Wednesday Thursday Friday Saturday Sunday Monday

17 18 19 20 21 22 23
24 25 26 27 28 29 30
10.0
3.9
00:00 12:00

Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetes Association, 7 June 2019, https://doi.org/10.2337/dci19-0028.

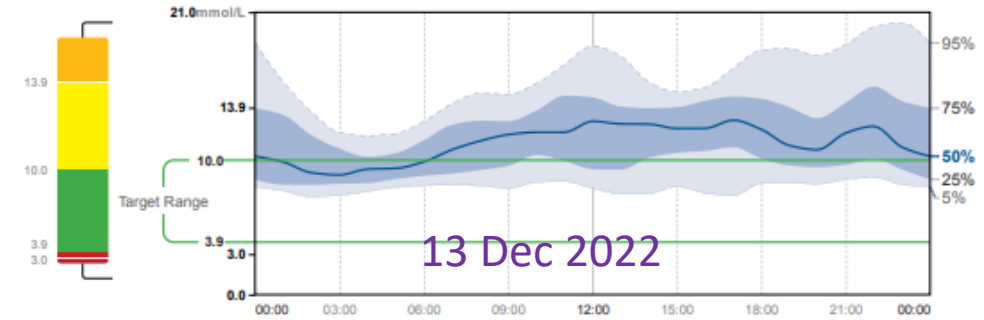
Mr Dan

2nd Visit Nurse Visit on 30 Jan 2022 (1 month later)

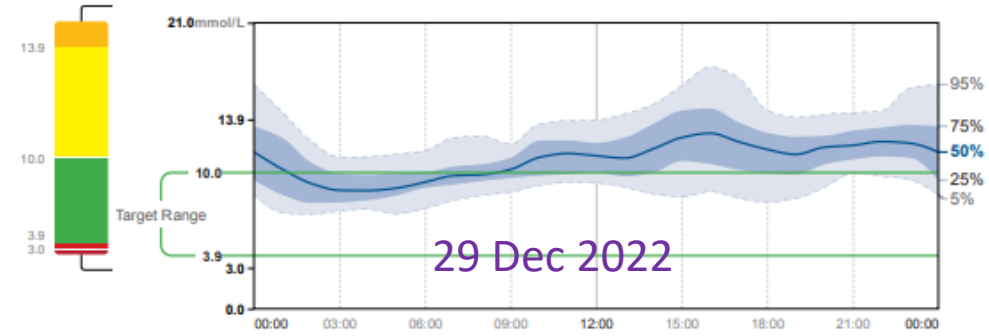
CGM 17-30 Jan 2023
14 Days readings; 89% Time sensor is Active

TAR 3%; **TIR 97%**;**TBR 0% **(Target > 70%)**
>13.9mmol/L: 20% → 10% **→ 0%**
10.1-13.9 mmol/L: 41% → 51% **→ 3%**
Average glucose 11.5→ 10.9 **→ 7.2** mmol/L
GMI 8.2% → 8.0% →**6.4%**
GV 25.3 → 20.6% → **18.2%**

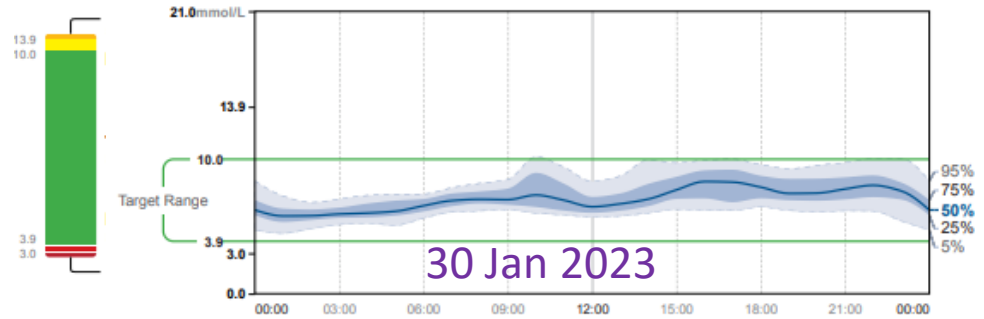
-Good drug compliance, without GI upset/ UTI
-motivated in lifestyle change
-decrease dining out with optimal CHO intake
-weight lifting daily 40 mins
-weight loss with 1.2kg in one month
-patient keen to continue CGM; reminded proper scanning to review glucose



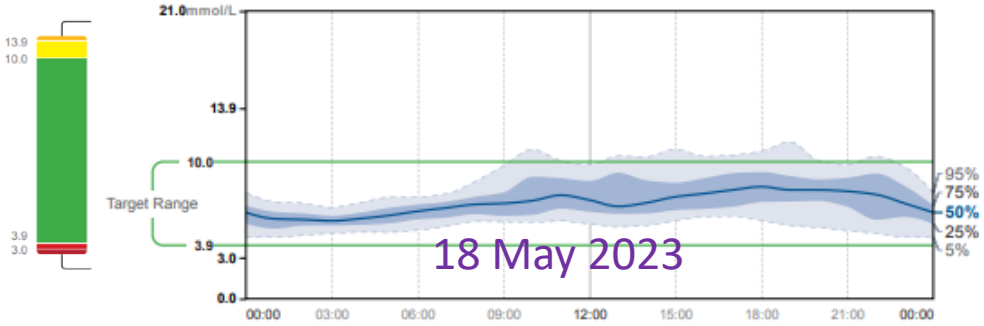
13 Dec 2022



29 Dec 2022



30 Jan 2023



18 May 2023

Mr Dan

DM Clinic FU on 18 May 2023 (3 months later)

5 May 2023 - 18 May 2023 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

5 May 2023 - 18 May 2023	**14 Days**
Time sensor active:	**73%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)

Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose	**7.1** mmol/L
Glucose Management Indicator (GMI)	**6.4% or 46 mmol/mol**
Glucose Variability	**22.4%**
Defined as percent coefficient of variation (%CV)	

TIME IN RANGES



Very High	>13.9 mmol/L	**0%** (0min)
High	10.1 - 13.9 mmol/L	**6%** (1h 26min)
Target Range	3.9 - 10.0 mmol/L	**94%** (22h 34min)
Low	3.0 - 3.8 mmol/L	**0%** (0min)
Very Low	<3.0 mmol/L	**0%** (0min)

HbA1c 8.3% 29 Dec 2023→ HbA1c **6.9%** (17 May 2023)

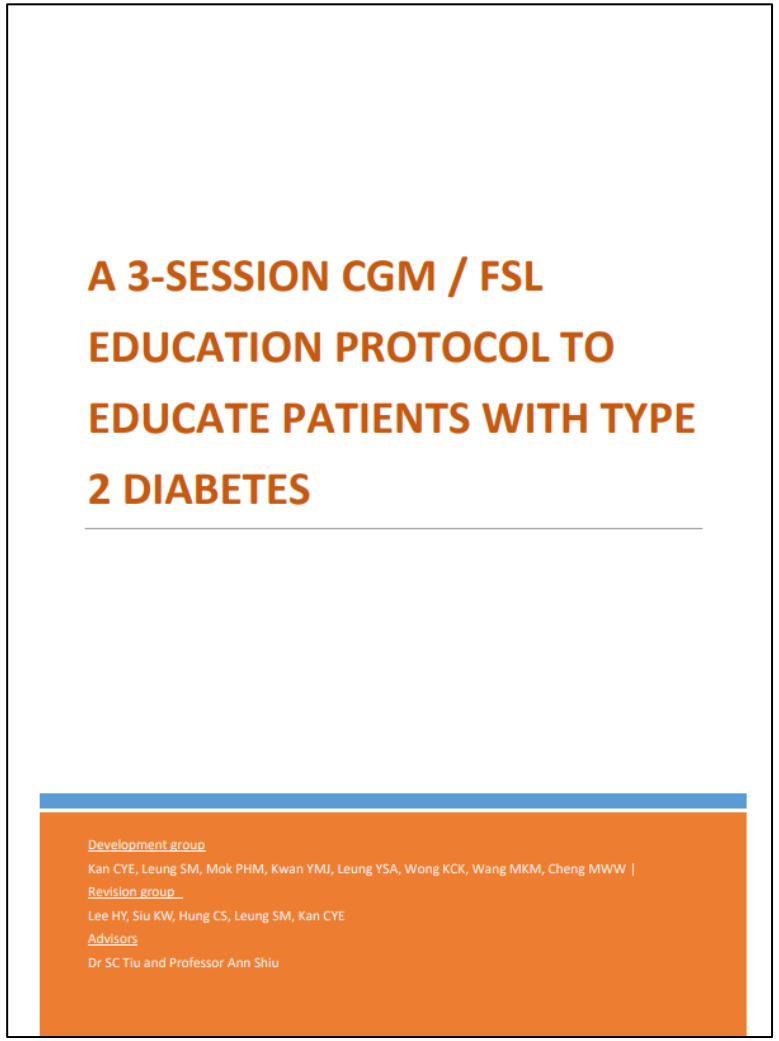
-Continuous use of CGM help patient understood lifestyle impact and progress on glucose profile

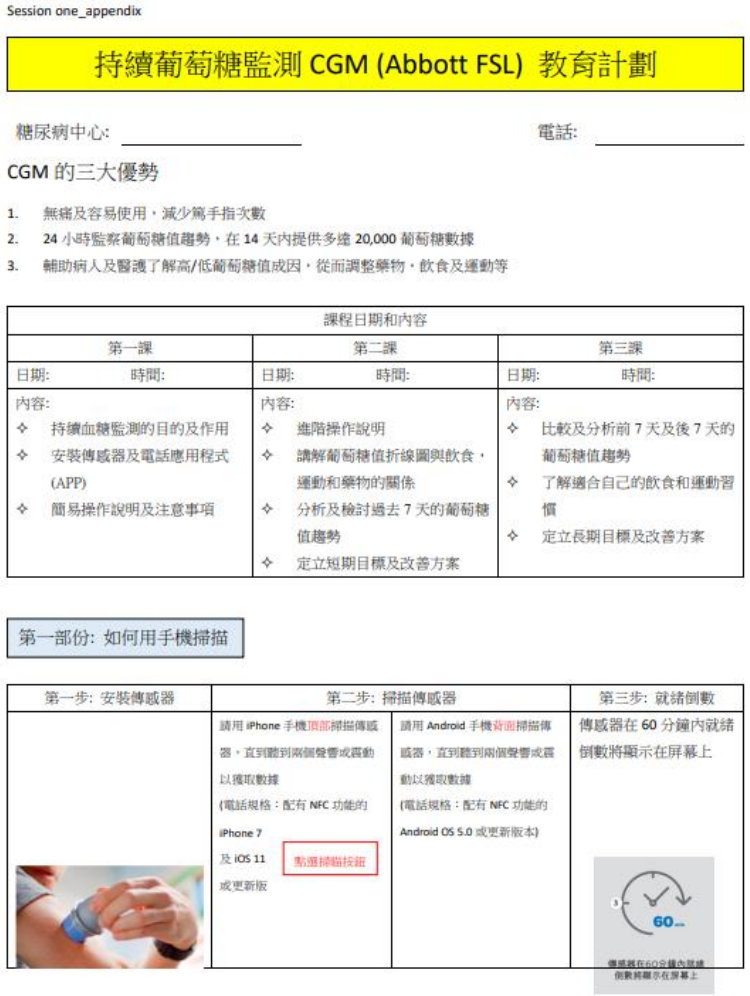
-Enhance treatment decision with drug adjustment

-Through education and empowerment, behaviour change

-Improvement in diet control, physical activity, drug adherence and glycaemic control……quality of life

CGM (Freestyle Libre) Education Protocol for T2 Diabetes





Session one_appendix

持續葡萄糖監測 CGM (Abbott FSL) 教育計劃

糖尿病中心: _____ 電話: _____

CGM 的三大優勢

1. 無痛及容易使用，減少篤手指次數
2. 24 小時監察葡萄糖值趨勢，在 14 天內提供多達 20,000 葡萄糖數據
3. 輔助病人及醫護了解高/低葡萄糖值成因，從而調整藥物，飲食及運動等

課程日期和內容		
第一課	第二課	第三課
日期: 時間:	日期: 時間:	日期: 時間:
內容: ✧ 持續血糖監測的目的及作用 ✧ 安裝傳感器及電話應用程式 (APP) ✧ 簡易操作說明及注意事項	內容: ✧ 進階操作說明 ✧ 講解葡萄糖值折線圖與飲食，運動和藥物的關係 ✧ 分析及檢討過去 7 天的葡萄糖值趨勢 ✧ 定立短期目標及改善方案	內容: ✧ 比較及分析前 7 天及後 7 天的葡萄糖值趨勢 ✧ 了解適合自己的飲食和運動習慣 ✧ 定立長期目標及改善方案

第一部份: 如何用手機掃描

第一步: 安裝傳感器	第二步: 掃描傳感器		第三步: 就緒倒數
	請用 iPhone 手機頂部掃描傳感器，直到聽到兩個聲響或震動以獲取數據 (電話規格：配有 NFC 功能的 iPhone 7 及 iOS 11 或更新版 點選掃描按鈕	請用 Android 手機背面掃描傳感器，直到聽到兩個聲響或震動以獲取數據 (電話規格：配有 NFC 功能的 Android OS 5.0 或更新版本)	傳感器在 60 分鐘內就緒倒數將顯示在屏幕上

Will be uploaded at AHKDN website www.ahkdn.com

Coming future……

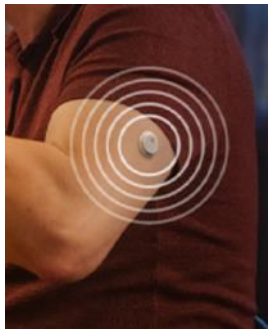
- **Libre 2**
- Blue tooth connectivity
- Optional alerts for high and low blood glucose
- FDA approved non-adjunctive integrated iCGM
- (iCGM that can be used as part of an integrated system with other compatible medical devices, software and electronic interfaces)
- No finger prick required
- MARD 9.3% (9.2% for adult and 9.7% for Paedi)

Libre 2



[FreeStyle Libre 2 System | CGM with Real-Time Glucose Alarms]

Libre 3





Smaller size
MARD 7.9%

Libre 1 – 30mmx5mm vs Libre 3 20mmx3mm

[FreeStyle Libre 3 System | Our Smallest CGM Sensor]

Dexcom G7



Dexcom G7



Dexcom Apps



Dexcom G6 App



Dexcom Clarity App



Dexcom Follow



Dexcom G7 App



Dexcom Clarity App



Dexcom Follow



- No fingerstick, scanning, or calibration
- Real-time glucose readings sent every 5 minutes
- Sensor worn for 10 days
- Age 2-6: Upper arm, abdomen or upper buttock
- Age 7 or older: Back of upper arm or abdomen
- Remote monitoring and sharing
- FDA approves treatment option without fingerstick

NEW in G7 !!



- **All-in-one**
- **Smaller sensor**
- **Over patch**
- **30-minute sensor warmup**
- **12-hour grace period**
- **Dexcom Clarity in mobile app**
- **Alert settings**
- **10 followers**
- **Data backfill up to 24 hours**
- **MARD**
  - **8.2% Adults**
  - **8.1% Children**

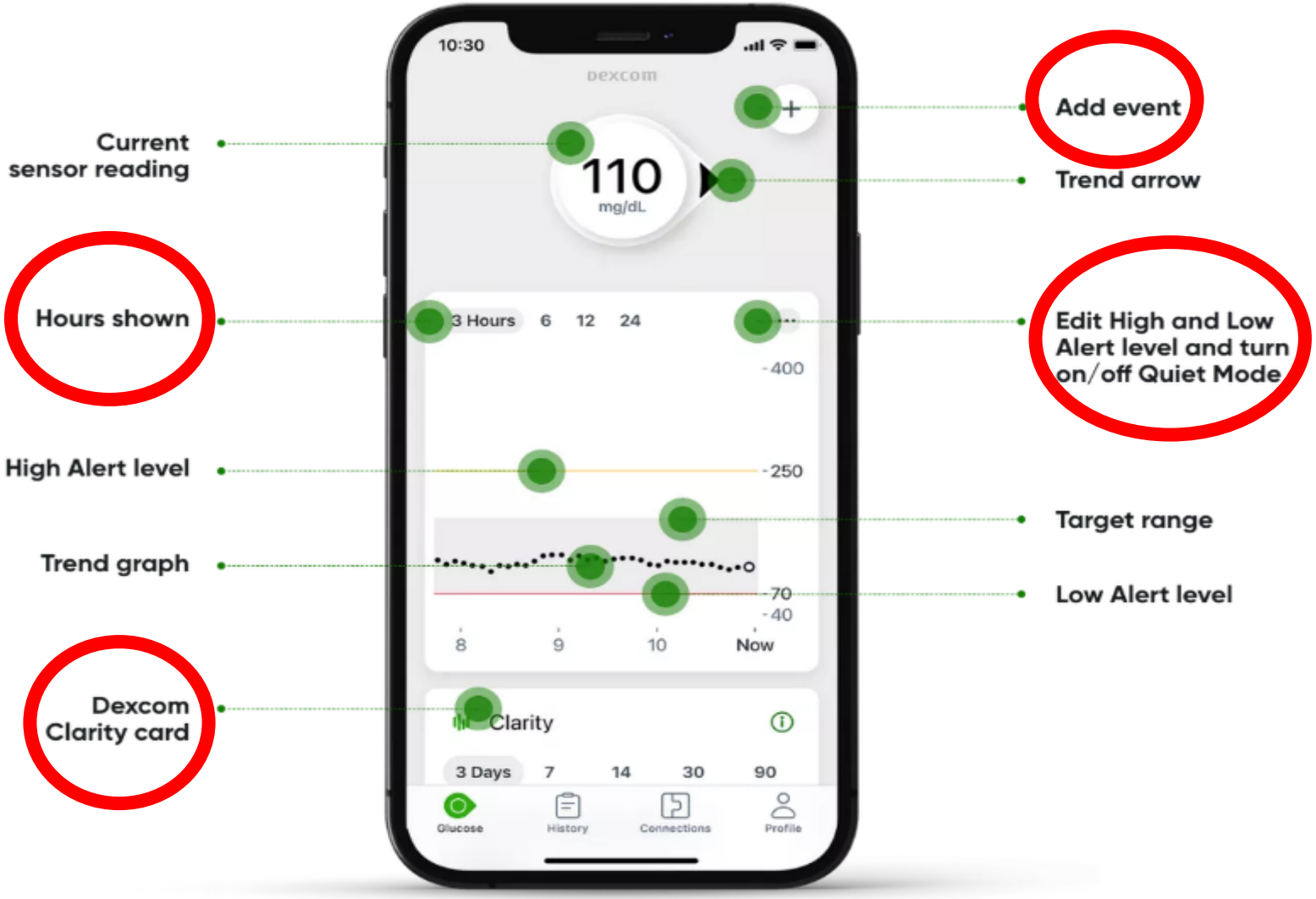
Points to note before use

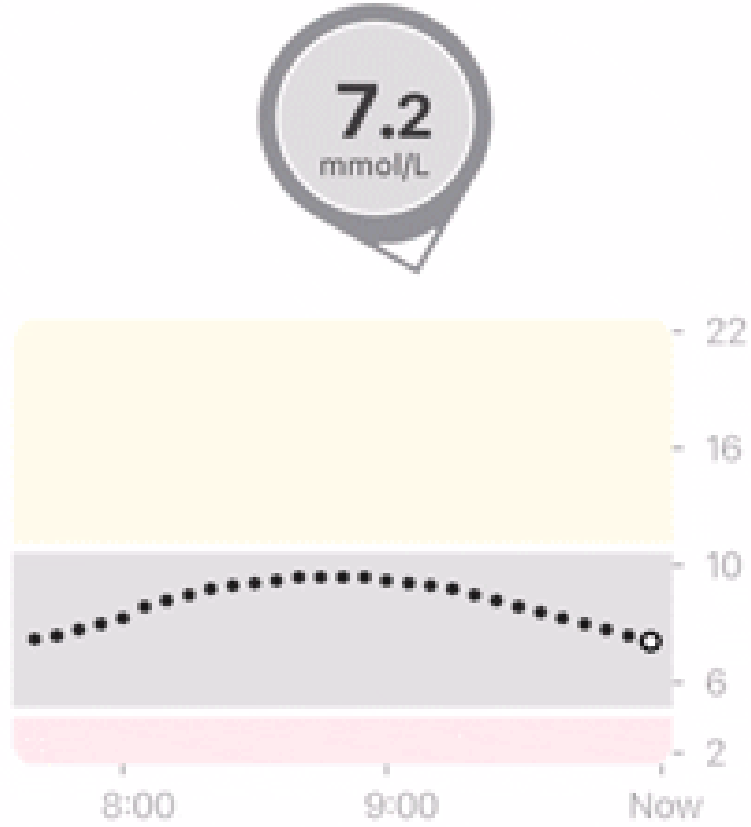
- 2.2-22.2 mmol/L



- Drugs effect: Hydroxyurea, Hydroxycarbamide, Paracetamol >1g every 6hrs
  - may be falsely elevated
  - missed hypoglycemia alerts or errors in diabetes management decisions
- Investigations:
  - CT scan:
    - keep the sensor out of the scanned area
    - cover the sensor with a lead apron during the scan
  - Removed if X-ray, MRI, high-frequency electrical heat (diathermy) treatment
- Don't use if on dialysis or critically ill
- 1st day with more discrepancy

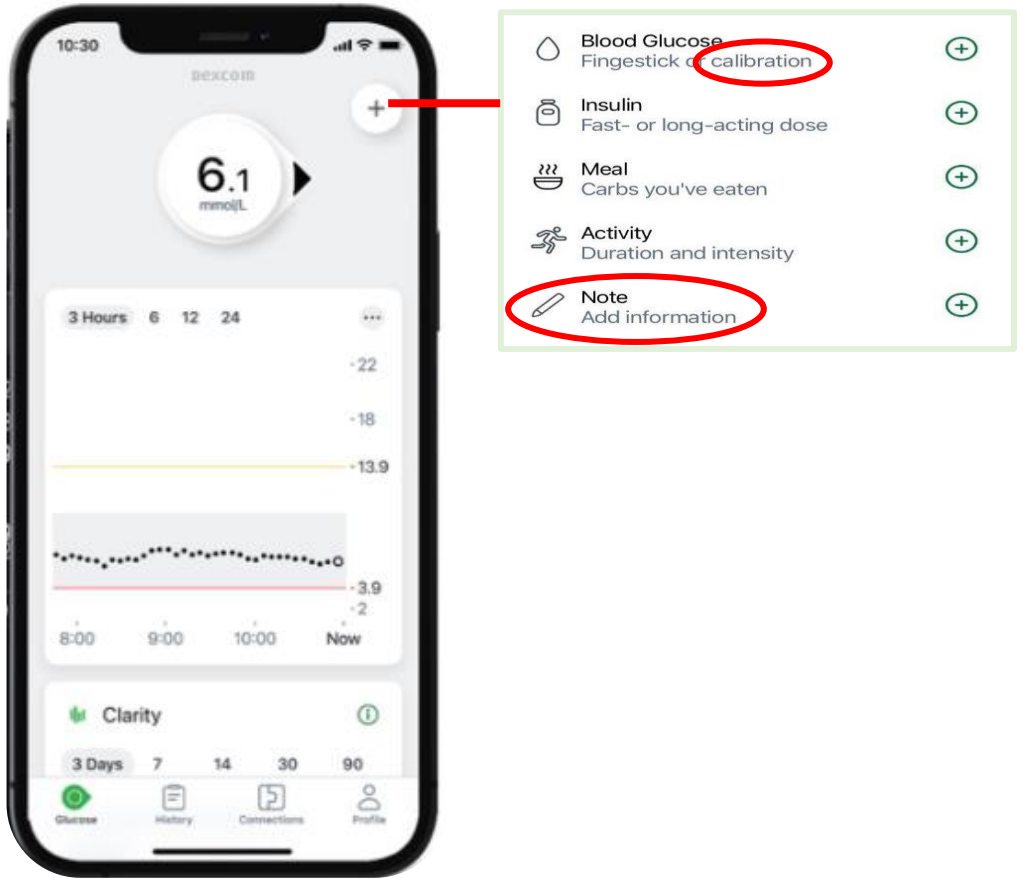
Dexcom G7 App





Dexcom G7 App: Add events

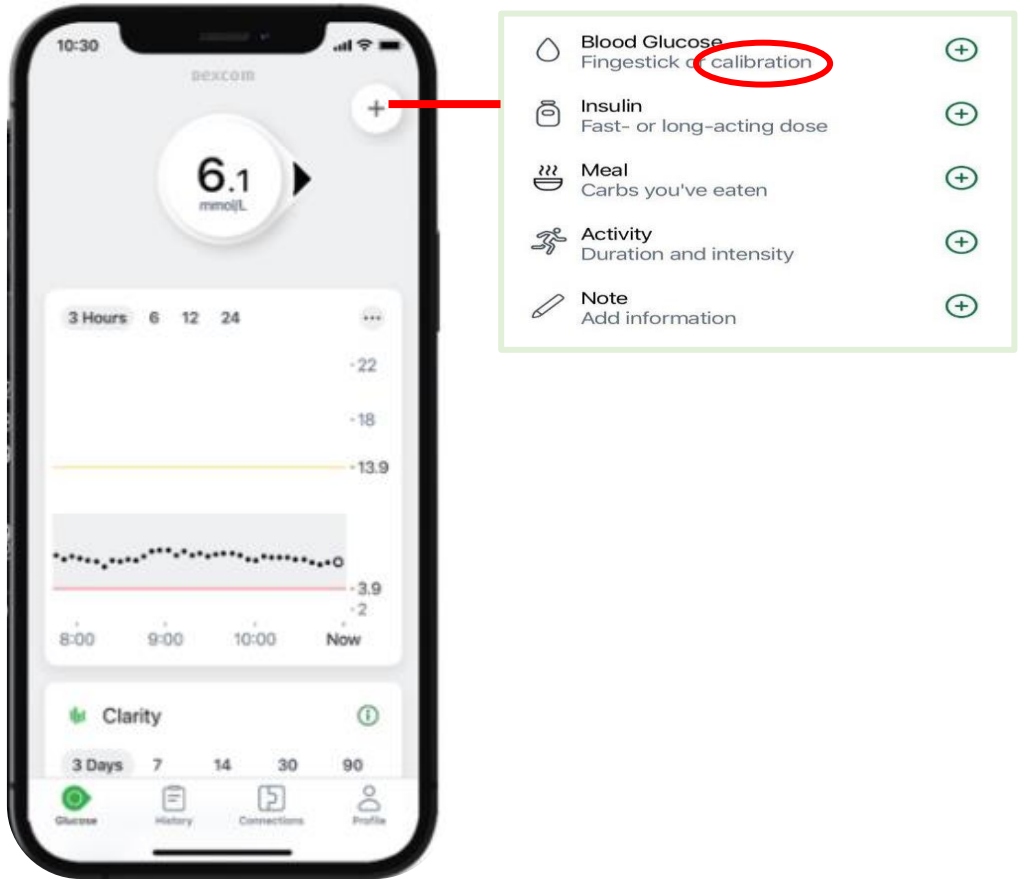
1. Blood glucose:
   - Fingerstick or ***Calibration***
2. Insulin
   - Fast- or long-acting insulin dose
3. Meal
   - Carbs you've eaten
4. Activity
   - Duration (min)
   - Intensity: Light, medium or heavy
5. **Note**
   - ***Add information***

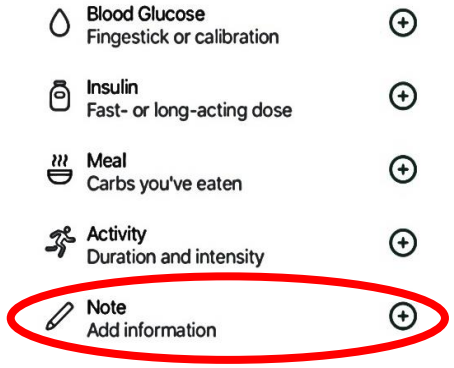


Calibration to G7

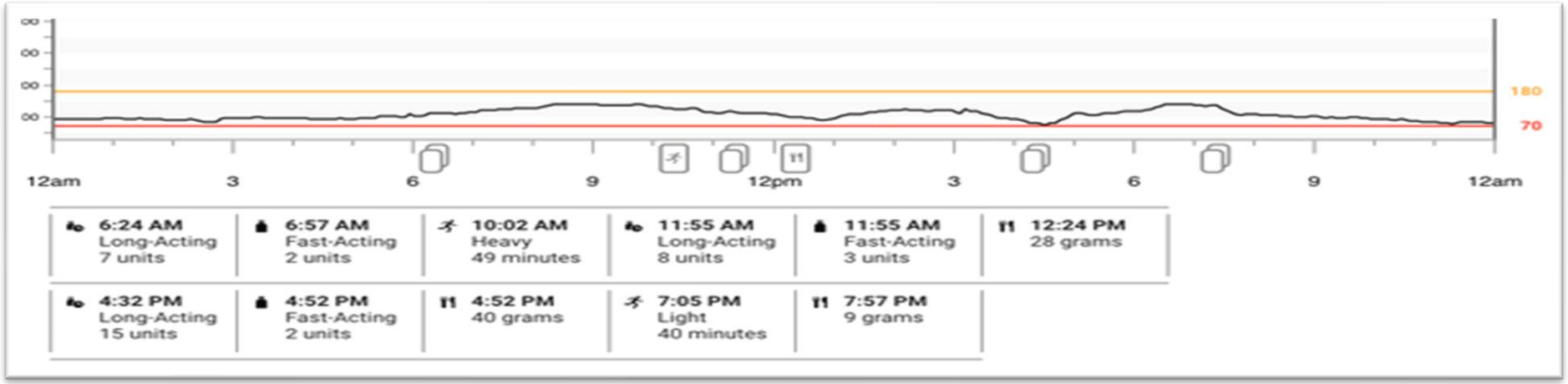
- Optional
- Bring the sensor readings closer to your BG meter value
- Makes more accurate or less accurate compared to the lab result

  - Don’t calibrate in these situations
    - Relieve pressure
    - Rapidly changing glucose
  - Clean hands
    - Wash your hands with soap and water
    - Dry hands
    - Enter the calibration within 5 minutes of taking a fingerstick
  - Meter values
    - Only BG meter values from 2.2 mmol/L to 22.2 mmol/L
  - “Calibration Not Used” alert:
    - Take another fingerstick and calibrate again





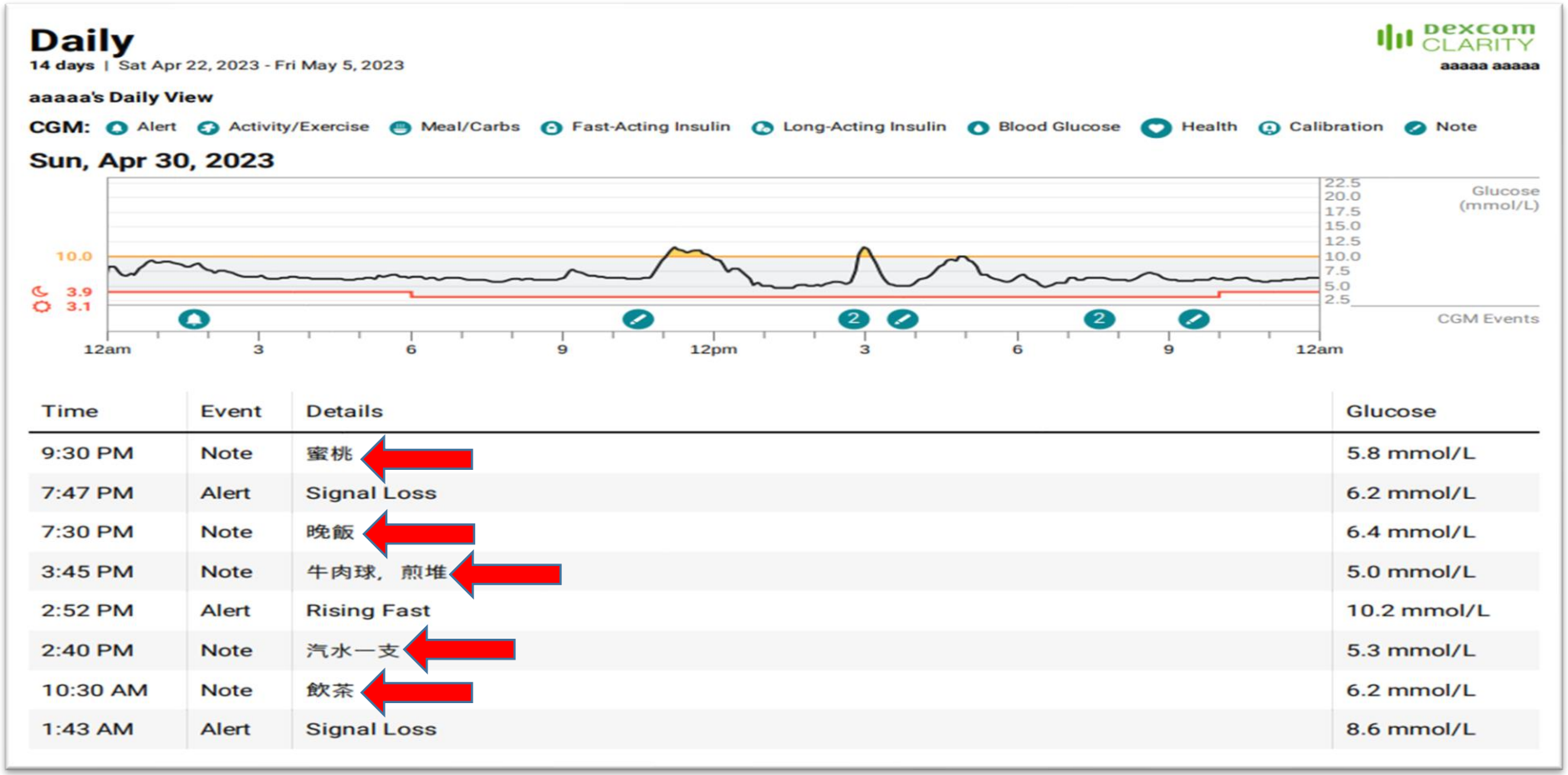
G6



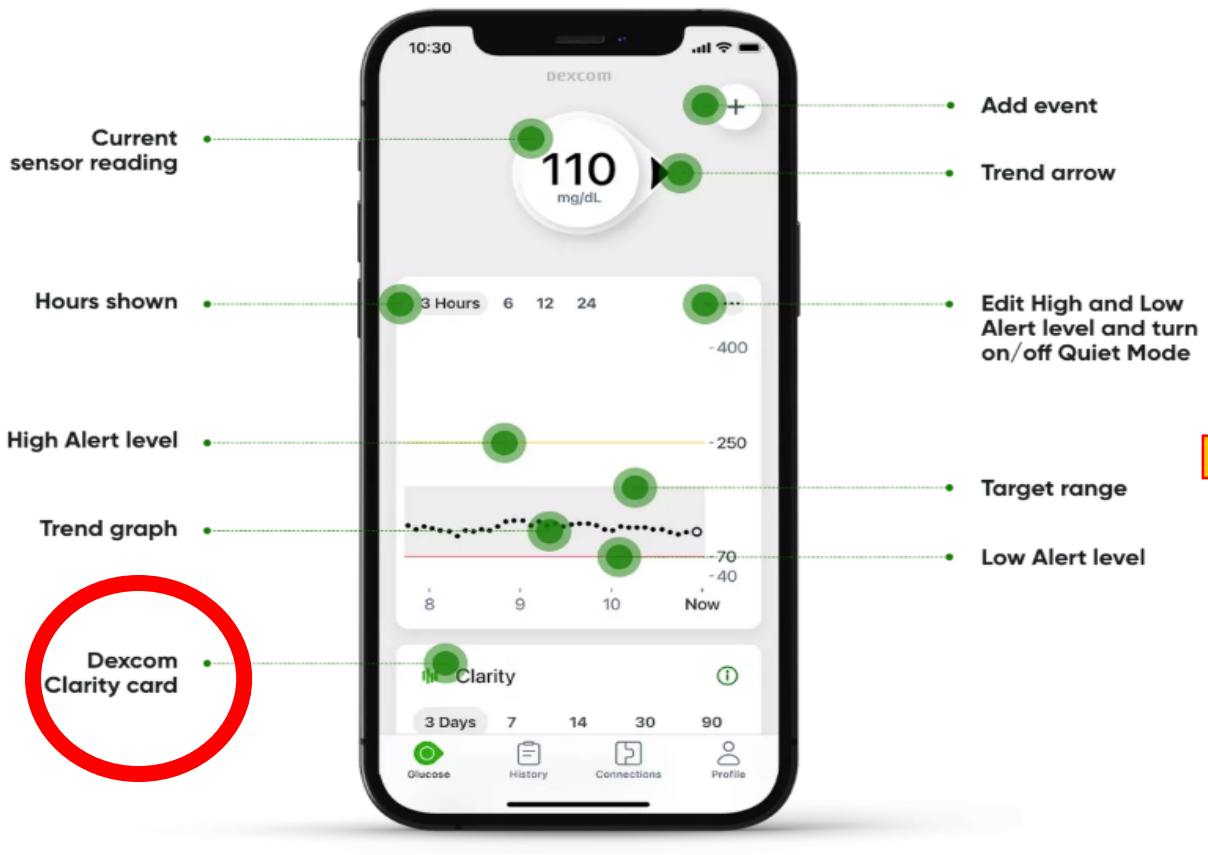
Note

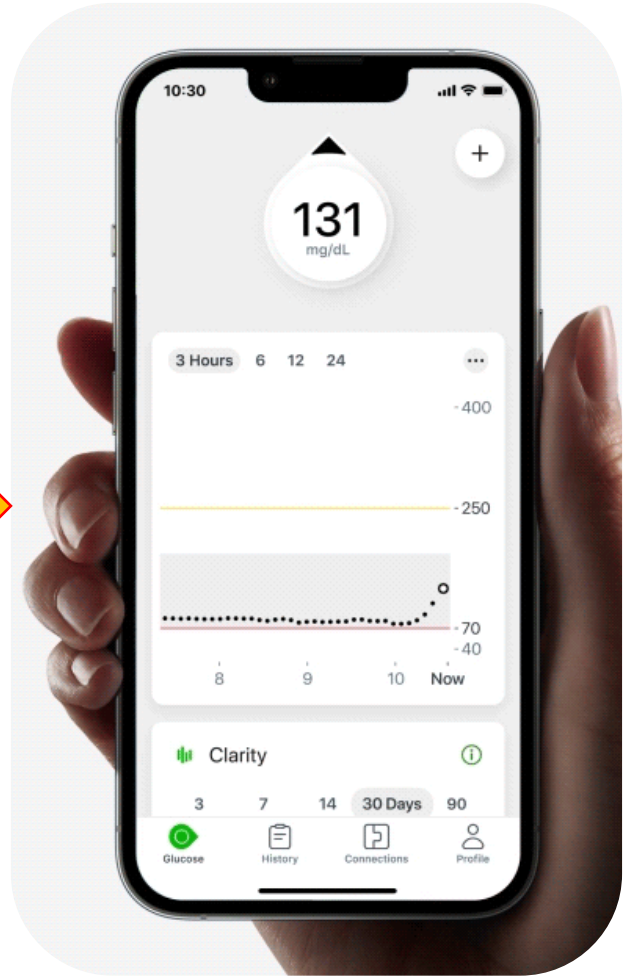
- Add information
  - Free format input (including Chinese input, emoji)
  - 140 words limit

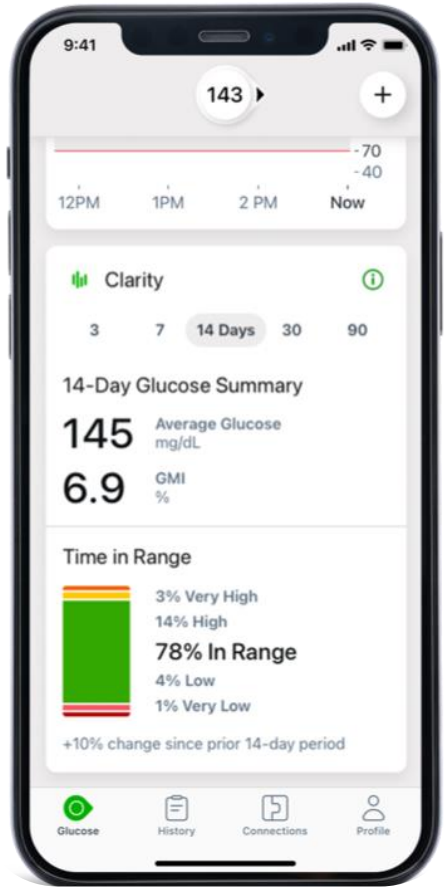
G7



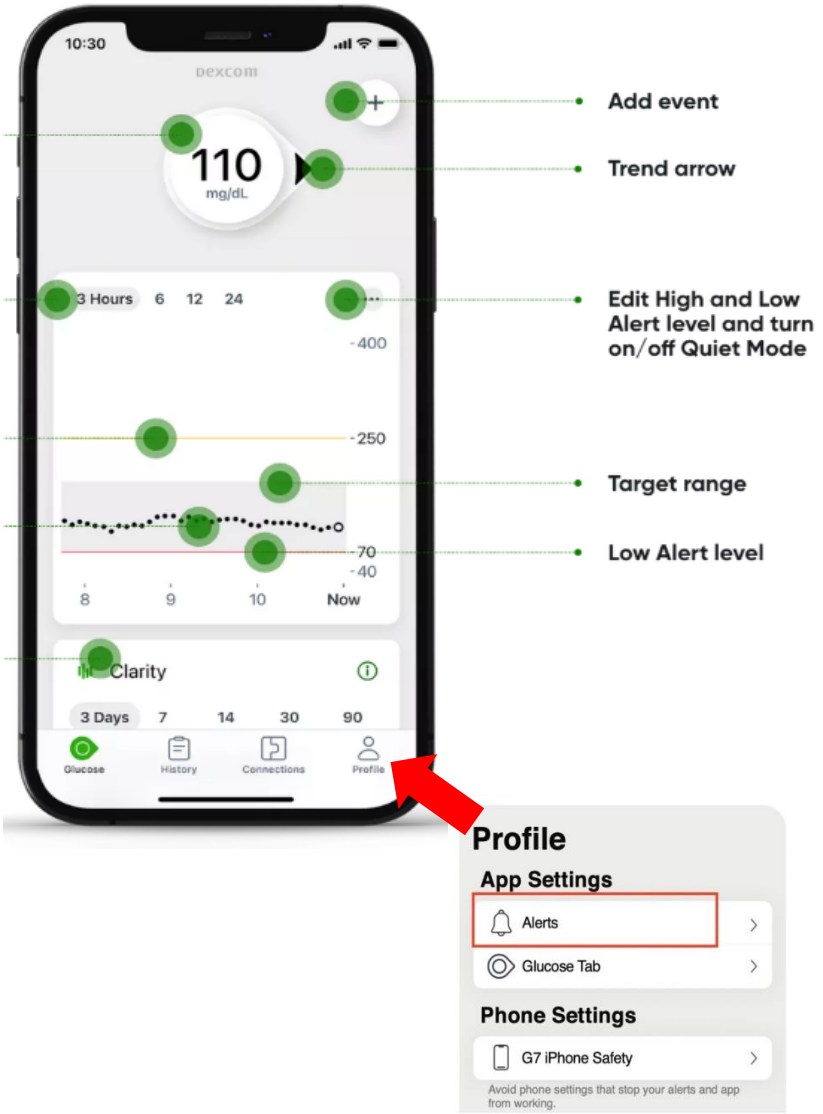
Dexcom G7 App: Dexcom Clarity card



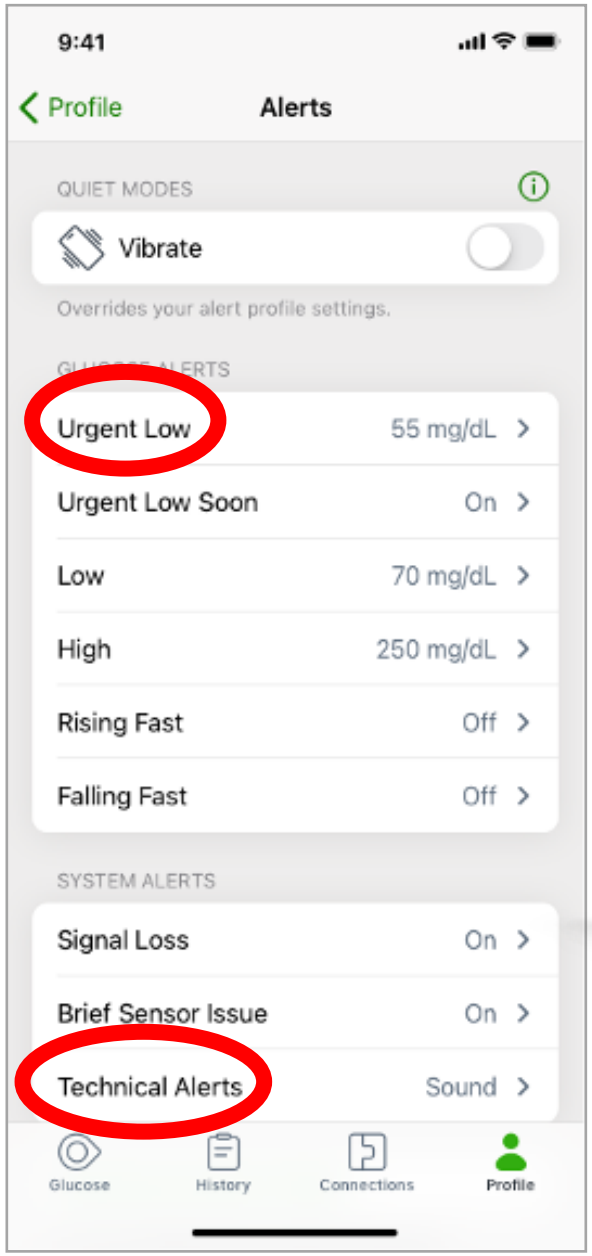




Alarms


10:30
dexcom
110
mg/dL
3 Hours 6 12 24
400
250
70
40
8 9 10 Now
Clarity
3 Days 7 14 30 90
Glucose History Connections Profile
Add event
Trend arrow
Edit High and Low Alert level and turn on/off Quiet Mode
Target range
Low Alert level

Profile
App Settings
Alerts
Glucose Tab
Phone Settings
G7 iPhone Safety
Avoid phone settings that stop your alerts and app from working.

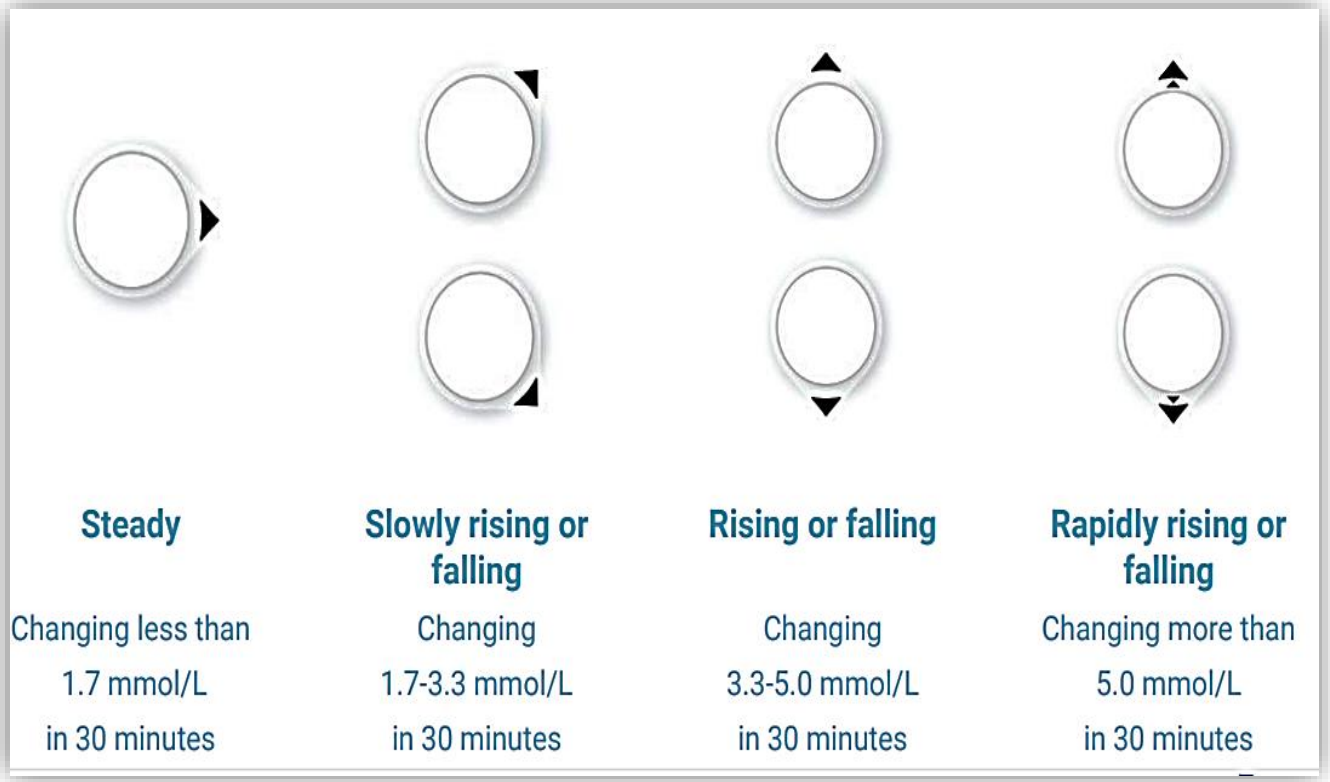

9:41
Profile
Alerts
QUIET MODES
Vibrate
Overrides your alert profile settings.
Urgent Low 55 mg/dL
Urgent Low Soon On
Low 70 mg/dL
High 250 mg/dL
Rising Fast Off
Falling Fast Off
SYSTEM ALERTS
Signal Loss On
Brief Sensor Issue On
Technical Alerts Sound
Glucose History Connections Profile


10:30
Urgent Low
3.1
mmol/L
3 Hours 6 12 24
8 9 10 Now
Clarity
10:30
3.1 mmol/L within 20 minutes
5.7
mmol/L
22
18
14.0
10
3.9
2
Clarity
Glucose History Connections Profile
12.0
mmol/L
Clarity
Days 7 14 30 90

Trend Arrows

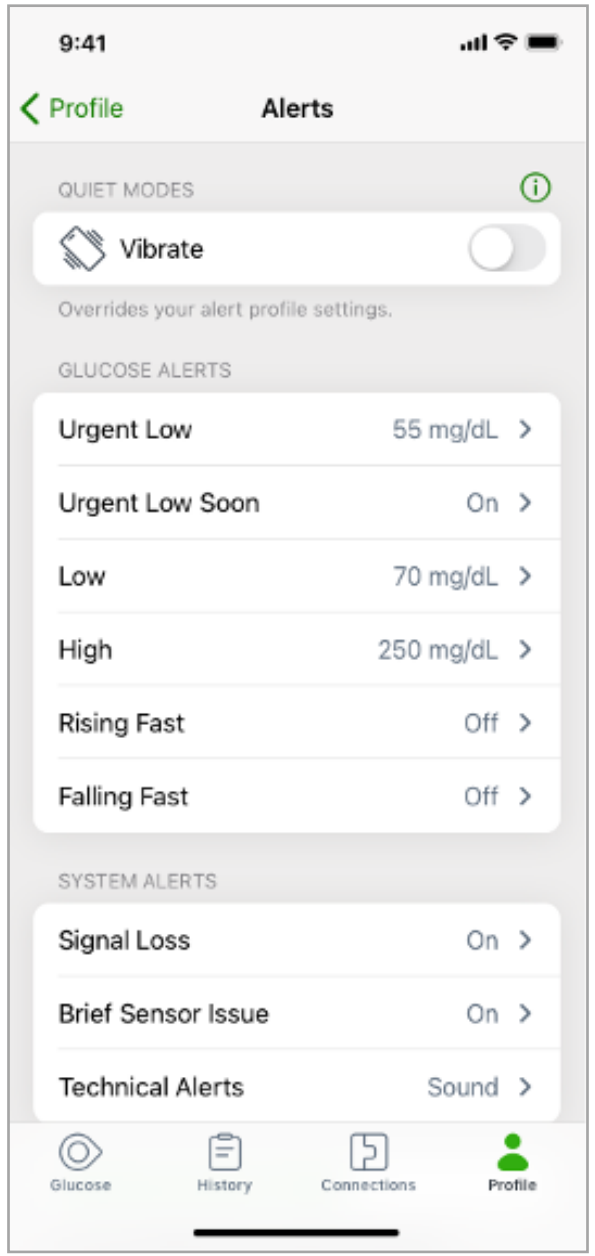
Dexcom Trend Arrows		
	Steady	Changing up to : - 0.06 mmol/L each minute - 1.8 mmol/L in 30 minutes
	Slowly rising or falling	Changing: - Between 0.06-0.1 mmol/L each minute - Up to 3.4 mmol/L in 30 minutes
	Rising or falling	Changing: - Between 0.1-0.2 mmol/L each minute - Up to 5 mmol/L in 30 minutes
	Rapidly rising or falling	Changing more than: - 0.2 mmol/L each minute - 5 mmol/L in 30 minutes
	No arrow	Cannot determine trend

G6



G7

Considerations on alarm setting



- Set alarm according to needs
  1. **Prevent hypoglycemia**
     - Urgent low soon: On, provide 20 mins advanced warning
     - Falling fast:
       - 0.1-0.2 mmol/L per min
       - Set level: 4.5 mmol/L

     2 mmol/L or more per min

     
  2. **Prevent high**
     - Rising fast:
       - 0.1-0.2 mmol/L per min
       - Set level: 12 mmol/L

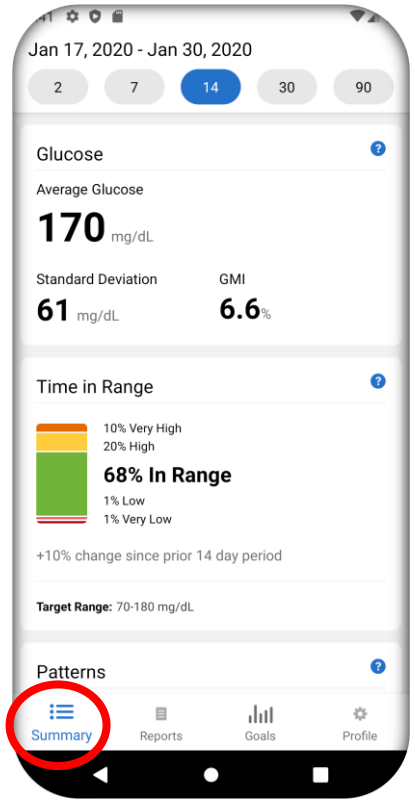
     

     .2 mmol/L or more per min

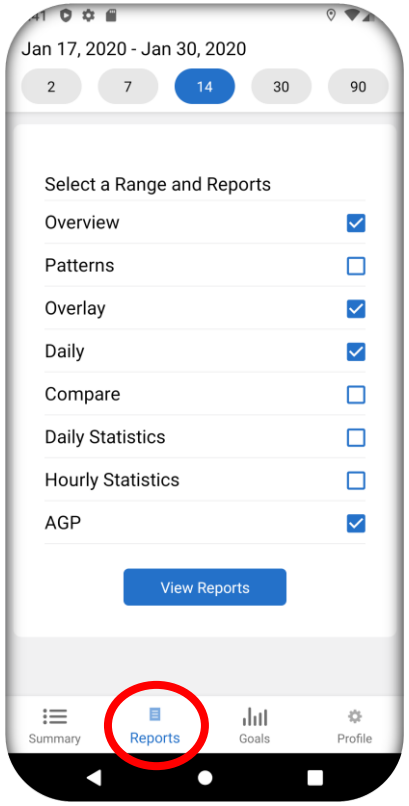
     
     - Delay 1st high alert until sensor i r a 15mins to 4 hours
  3. **Night time and day time**
     - Create separate alert profile in Add Second Alert Profile

- Technical alerts or urgent low
  - Cannot turn off
  - Silence all: no vibrate, no sound, visual notifications on screen up to 6 hours
  - Vibrate: all alarms will only vibrate, no sound; still escalate to sound if not acknowledged in 20 mins

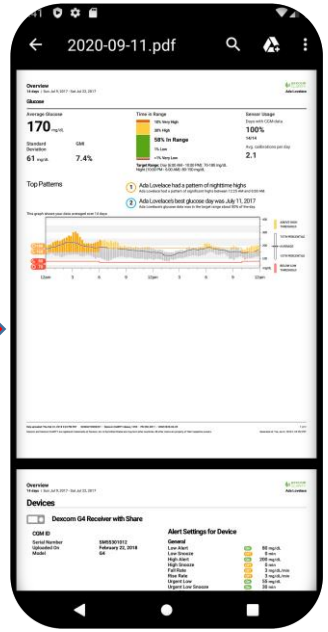
Dexcom Clarity App



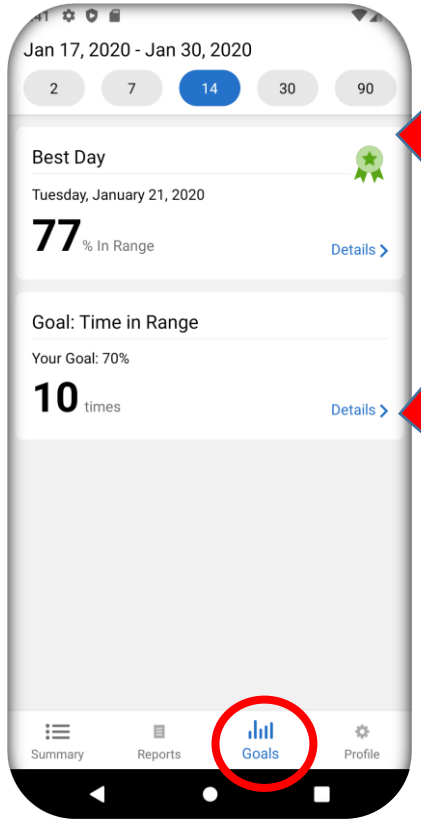
Summary



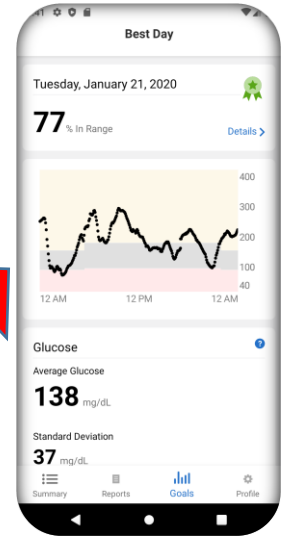
Reports:
Different presentation of CGM reports



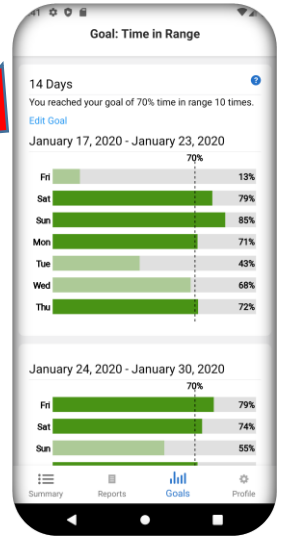
CGM report:
From Overview to AGP report



Goals:
Best day & TIR

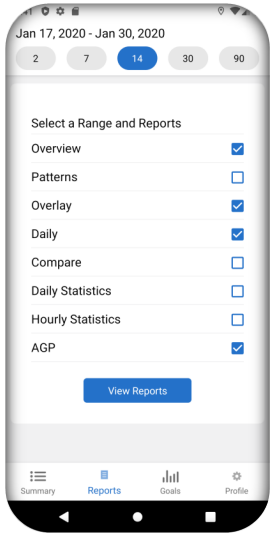


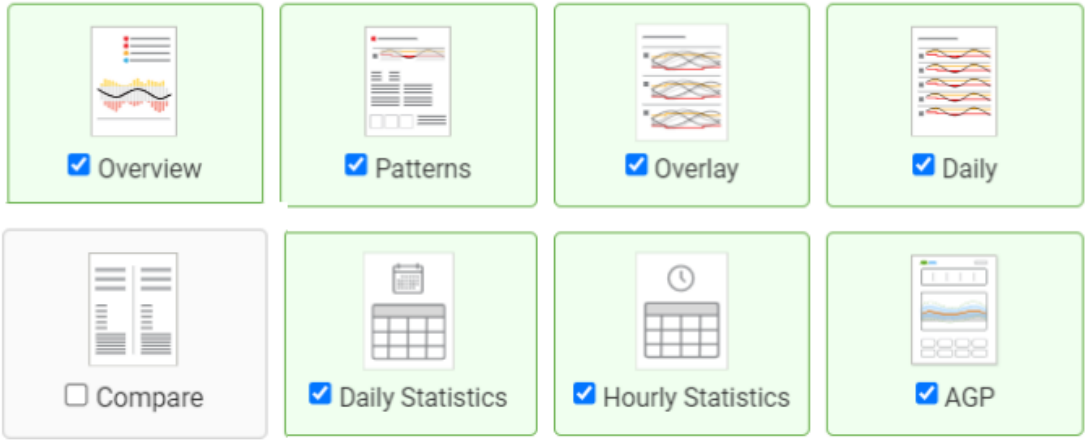
Best day



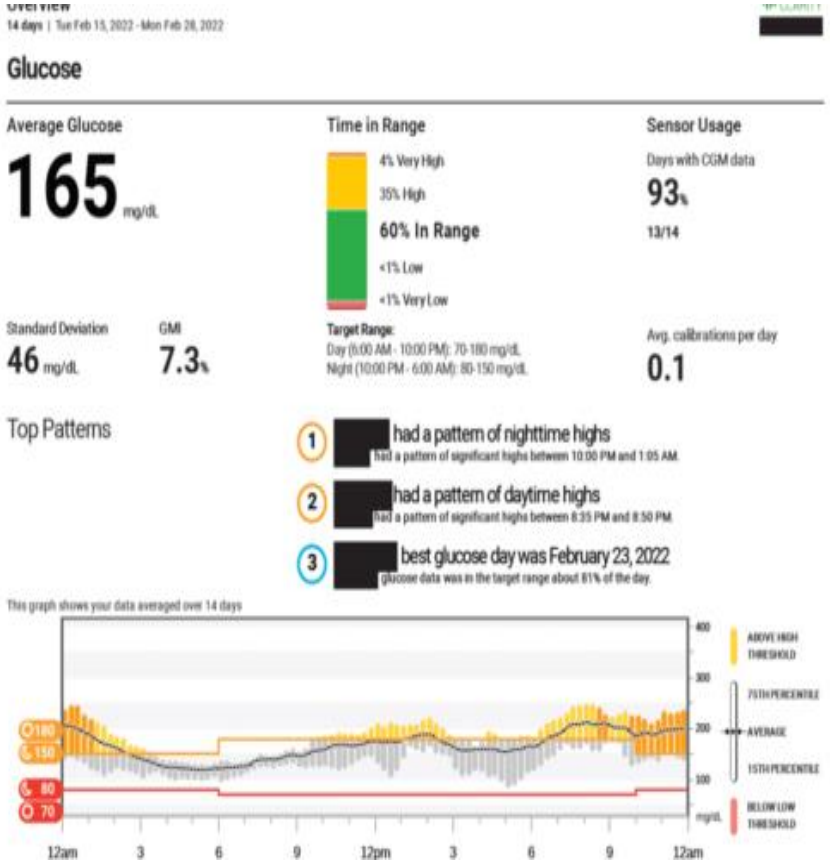
TIR: days

Reports: Different presentation of CGM reports



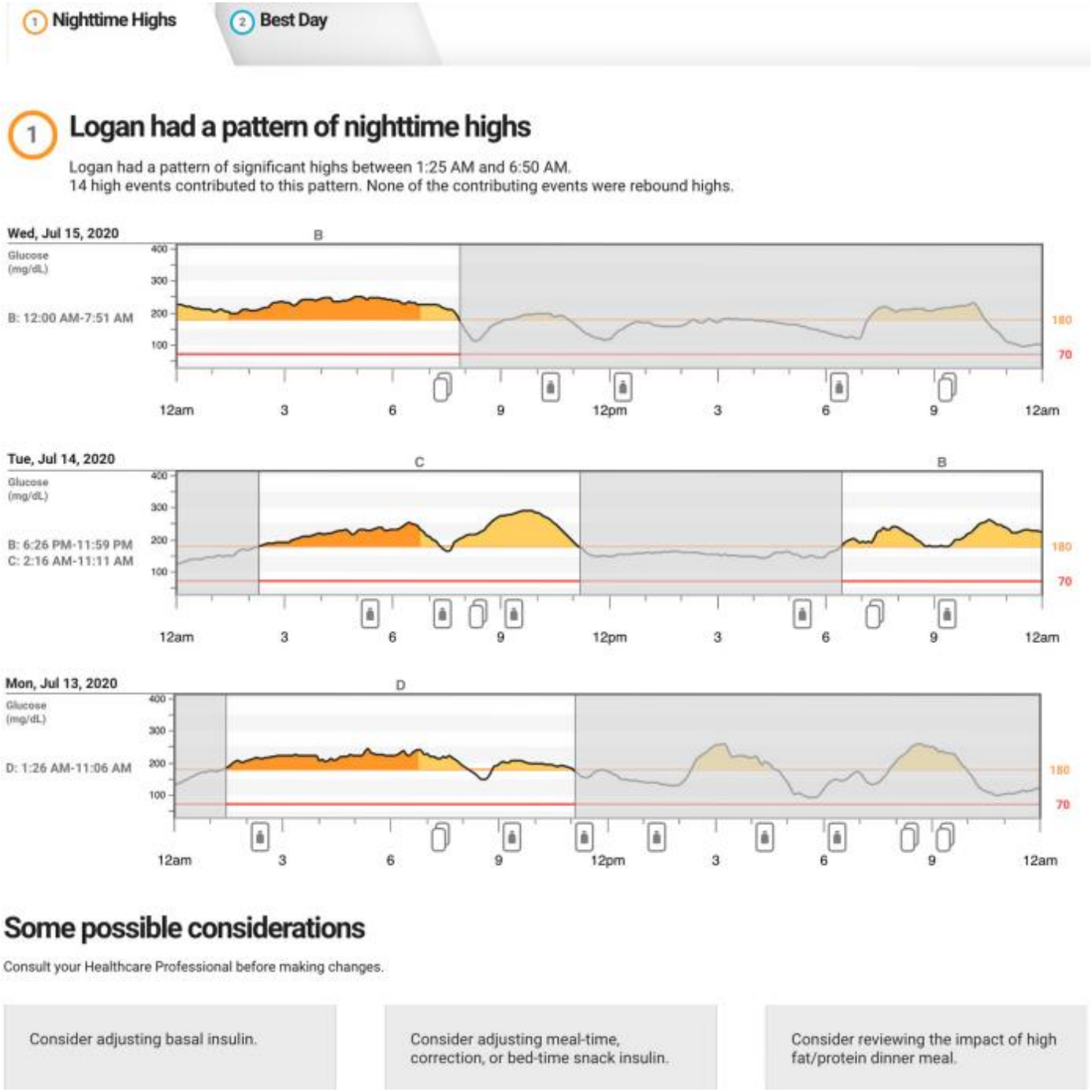


Overview



- Summary of the most relevant clinical information
  - ✓ Average glucose, TIR, sensor usage, SD, GMI (at least 12 days data), top patterns and alert settings
- Trends Report
  - ✓ Visual representation of patterns
  - ✓ Longer bars represent greater glycemic variability
    - Clinically significant hypoglycemia patterns are red
      - ☐ The most significant are bright red
    - Hyperglycemia patterns are yellow
      - ☐ The most significant are bright yellow
  - ✓ Outlier data
    - Removed to help focus on patterns
    - The top 25% and bottom 15%

Patterns



- Begin discussions of what, why, and how to address issues
- Opens the door to patient education
- If patients enter events into G7 app such as exercise
  - Icon displays below the graph
  - Help pinpoint contributing factors
- Possible considerations

Daily



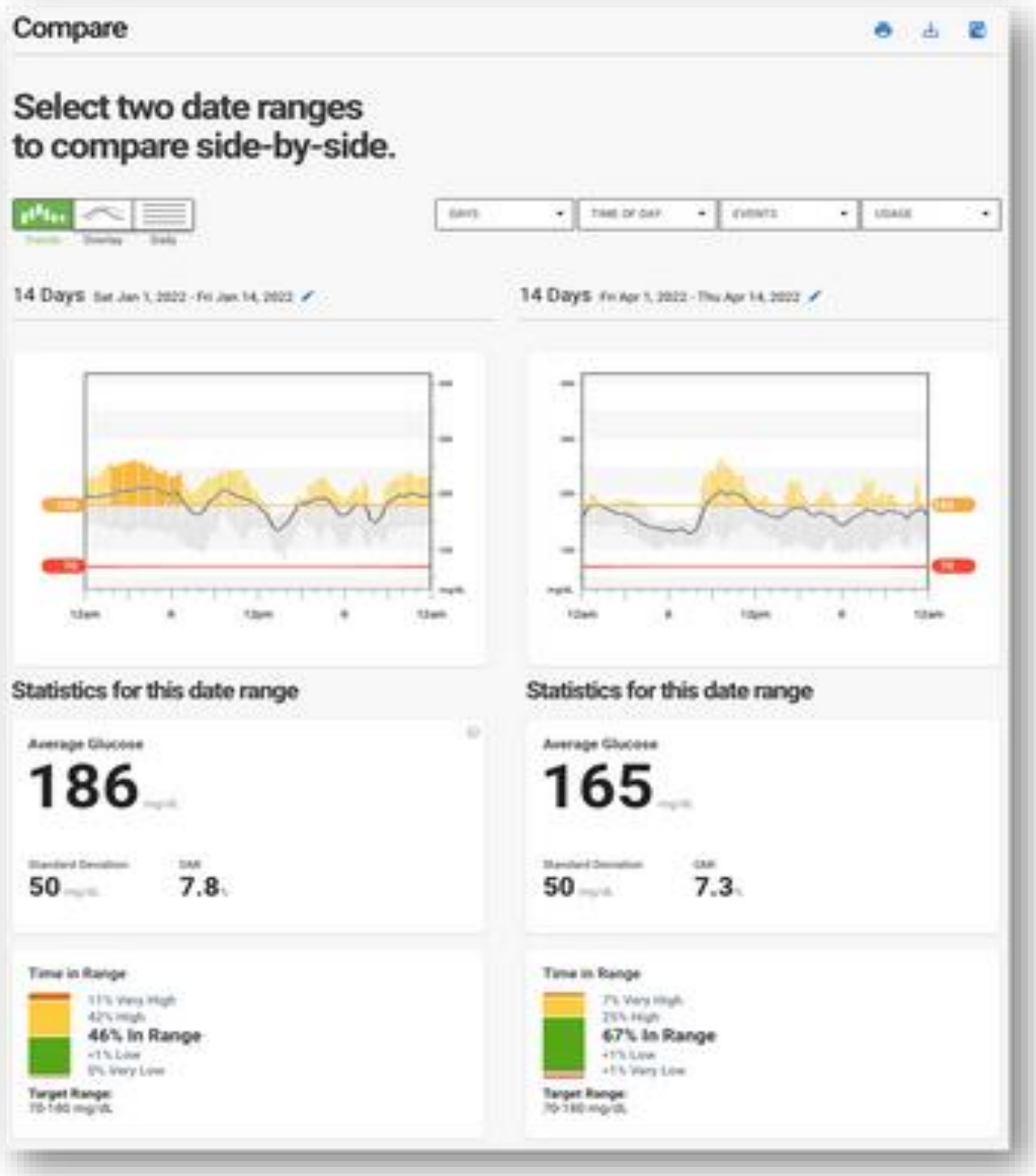
G6 CGM Report



G7 CGM Report

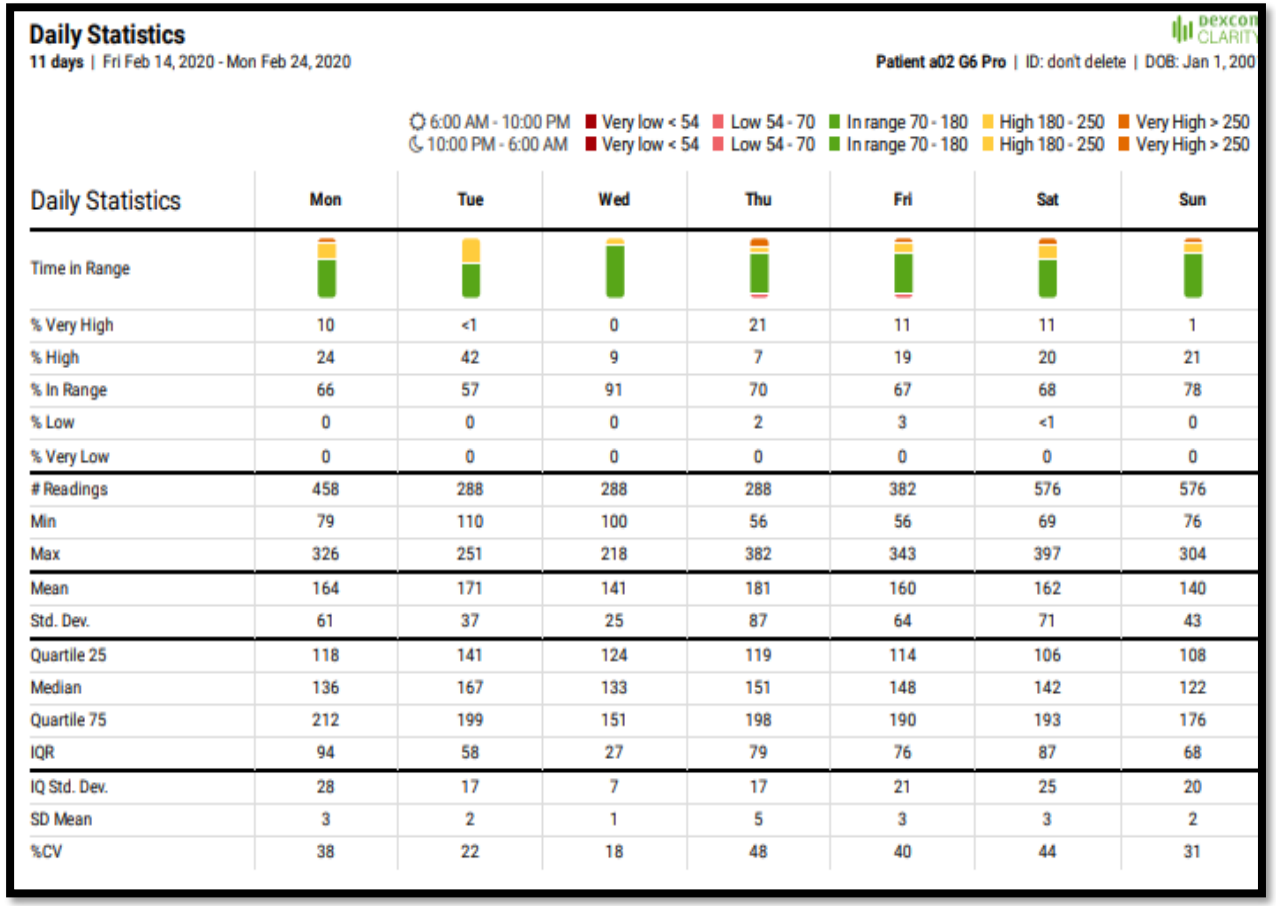
- Start from most recent day
  - ✓ Show glucose level changes of each day
- Events
  - ✓ At bottom of each graph
- Use Daily view
  - ✓ Talk in depth with patients regarding individual days and isolated events

Compare



- Select 2 date ranges to compare glucose level side by side
- Encourages progress and highlights the challenges patients may be facing
  - ◆ Medication adjustments
  - ◆ Activities change

Daily statistics



Daily Statistics

11 days | Fri Feb 14, 2020 - Mon Feb 24, 2020

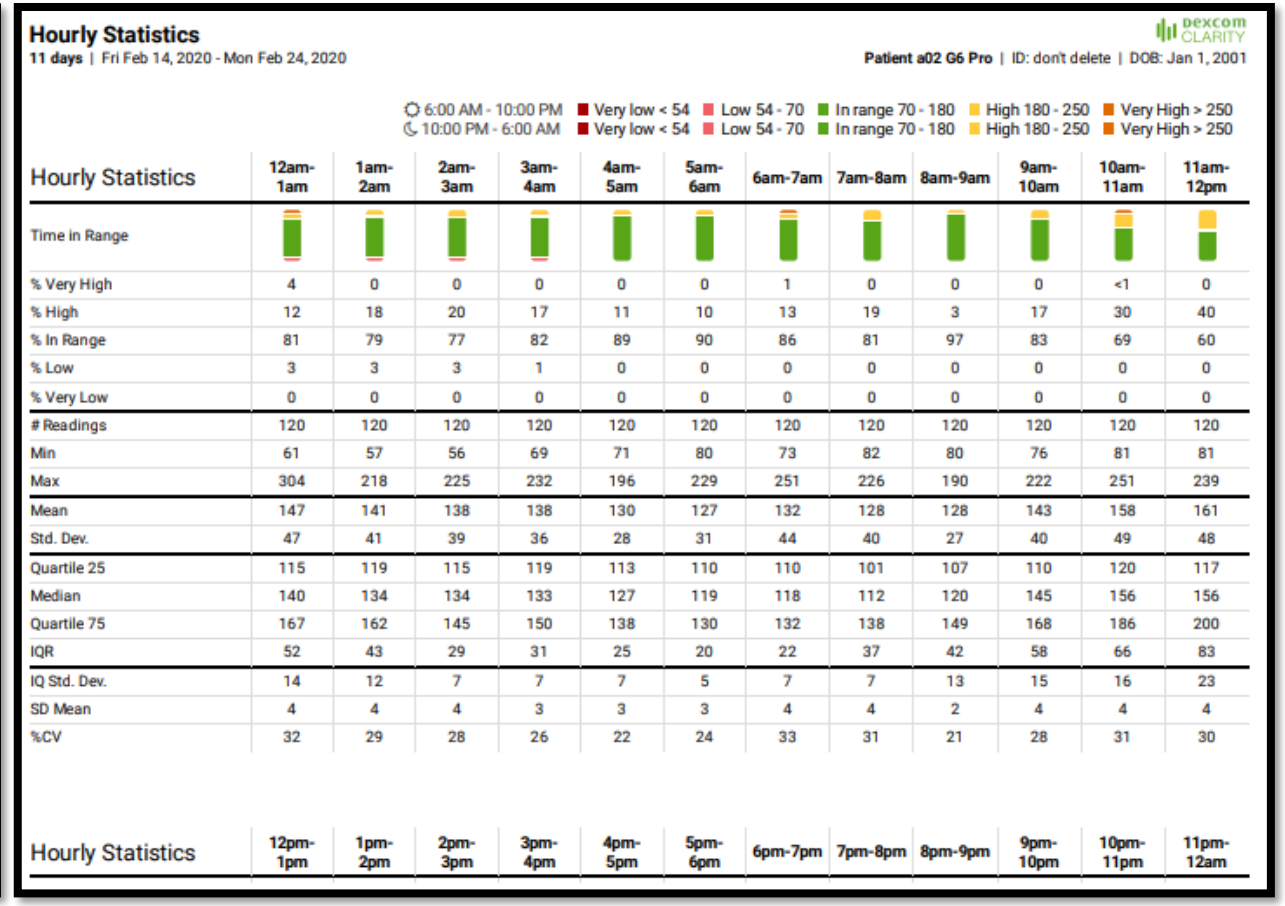
Patient a02 G6 Pro | ID: don't delete | DOB: Jan 1, 200

6:00 AM - 10:00 PM: Very low < 54 | Low 54 - 70 | In range 70 - 180 | High 180 - 250 | Very High > 250

10:00 PM - 6:00 AM: Very low < 54 | Low 54 - 70 | In range 70 - 180 | High 180 - 250 | Very High > 250

Daily Statistics	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Time in Range							
% Very High	10	<1	0	21	11	11	1
% High	24	42	9	7	19	20	21
% In Range	66	57	91	70	67	68	78
% Low	0	0	0	2	3	<1	0
% Very Low	0	0	0	0	0	0	0
# Readings	458	288	288	288	382	576	576
Min	79	110	100	56	56	69	76
Max	326	251	218	382	343	397	304
Mean	164	171	141	181	160	162	140
Std. Dev.	61	37	25	87	64	71	43
Quartile 25	118	141	124	119	114	106	108
Median	136	167	133	151	148	142	122
Quartile 75	212	199	151	198	190	193	176
IQR	94	58	27	79	76	87	68
IQ Std. Dev.	28	17	7	17	21	25	20
SD Mean	3	2	1	5	3	3	2
%CV	38	22	18	48	40	44	31

Hourly statistics



Hourly Statistics

11 days | Fri Feb 14, 2020 - Mon Feb 24, 2020

Patient a02 G6 Pro | ID: don't delete | DOB: Jan 1, 2001

6:00 AM - 10:00 PM: Very low < 54 | Low 54 - 70 | In range 70 - 180 | High 180 - 250 | Very High > 250

10:00 PM - 6:00 AM: Very low < 54 | Low 54 - 70 | In range 70 - 180 | High 180 - 250 | Very High > 250

Hourly Statistics	12am-1am	1am-2am	2am-3am	3am-4am	4am-5am	5am-6am	6am-7am	7am-8am	8am-9am	9am-10am	10am-11am	11am-12pm
Time in Range												
% Very High	4	0	0	0	0	0	1	0	0	0	<1	0
% High	12	18	20	17	11	10	13	19	3	17	30	40
% In Range	81	79	77	82	89	90	86	81	97	83	69	60
% Low	3	3	3	1	0	0	0	0	0	0	0	0
% Very Low	0	0	0	0	0	0	0	0	0	0	0	0
# Readings	120	120	120	120	120	120	120	120	120	120	120	120
Min	61	57	56	69	71	80	73	82	80	76	81	81
Max	304	218	225	232	196	229	251	226	190	222	251	239
Mean	147	141	138	138	130	127	132	128	128	143	158	161
Std. Dev.	47	41	39	36	28	31	44	40	27	40	49	48
Quartile 25	115	119	115	119	113	110	110	101	107	110	120	117
Median	140	134	134	133	127	119	118	112	120	145	156	156
Quartile 75	167	162	145	150	138	130	132	138	149	168	186	200
IQR	52	43	29	31	25	20	22	37	42	58	66	83
IQ Std. Dev.	14	12	7	7	7	5	7	7	13	15	16	23
SD Mean	4	4	4	3	3	3	4	4	2	4	4	4
%CV	32	29	28	26	22	24	33	31	21	28	31	30

Hourly Statistics	12pm-1pm	1pm-2pm	2pm-3pm	3pm-4pm	4pm-5pm	5pm-6pm	6pm-7pm	7pm-8pm	8pm-9pm	9pm-10pm	10pm-11pm	11pm-12am

- TIR for each day or TIR of each hour of different days
- Detect patterns and fluctuations at specific day or specific time of the day
  - E.g. during overnight, daytime, or around a specific meal or event

AGP report

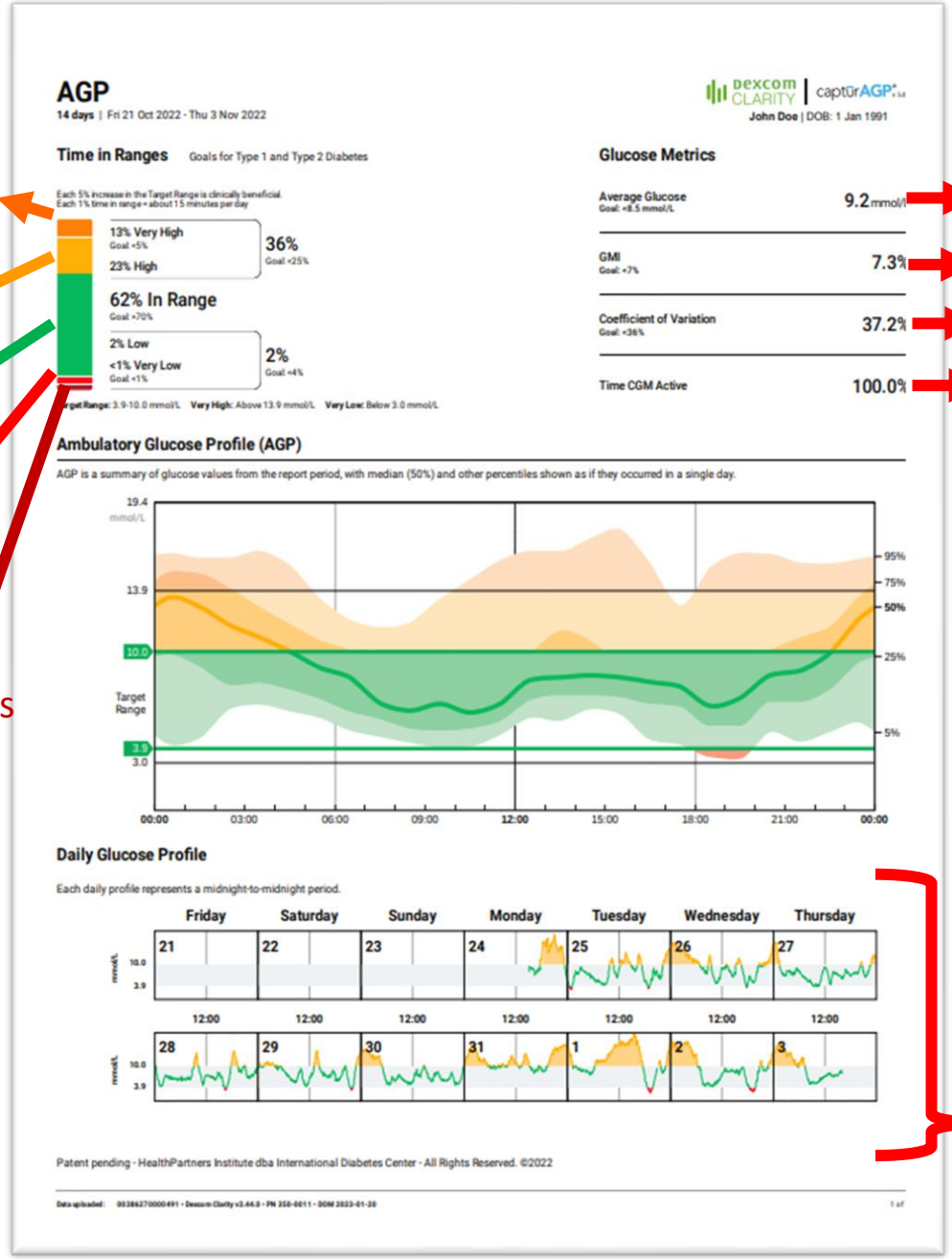
6. Time above range (TAR): % of readings and time **>13.9 mmol/L** Level 2

7. Time above range (TAR): % of readings and time **10.1–13.9 mmol/L** Level 1

8. Time in range (TIR): % of readings and time **3.9–10.0 mmol/L** In range

9. Time below range (TBR): % of readings and time **3.0–3.8 mmol/L** Level 1

10. Time below range (TBR): % of readings and time **<3.0 mmol/L** Level 2



3. Mean glucose

4. Glucose management indicator (GMI)

5. Glycemic variability (%CV)

2. % of sensor data captured

- **Summarize glucose values**
  - ✓ **Overall quality of glucose control**
- **Show variability around the mean glucose and high and low pattern**
- **Show single-day glucose values**
  - ✓ **Identify patterns and progress**

1. Number of days CGM worn

Optimal use

- Important characteristics of Dexcom G7
  - Alarms
  - Predictive function
    - Prevent hypoglycemia
    - Hypo-unawareness
  - Add note
- Use different presentations of CGM reports
  - identify reasons of highs and lows
- Wise alarm setting
- Check BGA whenever symptoms not match
- Patient SELF evaluation

Insulin pumps integration:
Omnipod 5
Tandem ControlIQ
Medtronic InPen

Guardian 4 sensor for CGMS, CSII & INpen

1. Guardian 4 sensor for CGMS

Updated

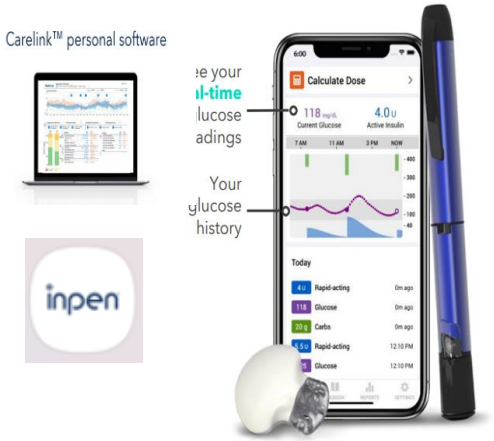


2. Exclusive for 780G CSII

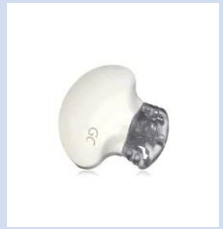
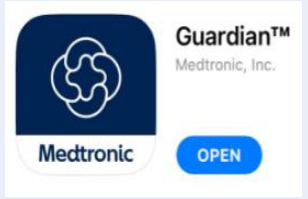


New

3. Exclusive for Inpen smart insulin pen system



Medtronic: standalone CGM

Individualized transmitter and apps	
Guardian 3 sensor (Guardian connect transmitter) -Connect by Bluetooth between apps and transmitter	 
Guardian 4 sensor (Guardian connect transmitter) -Connect by Bluetooth between apps and transmitter	 

Medtronic: CSII



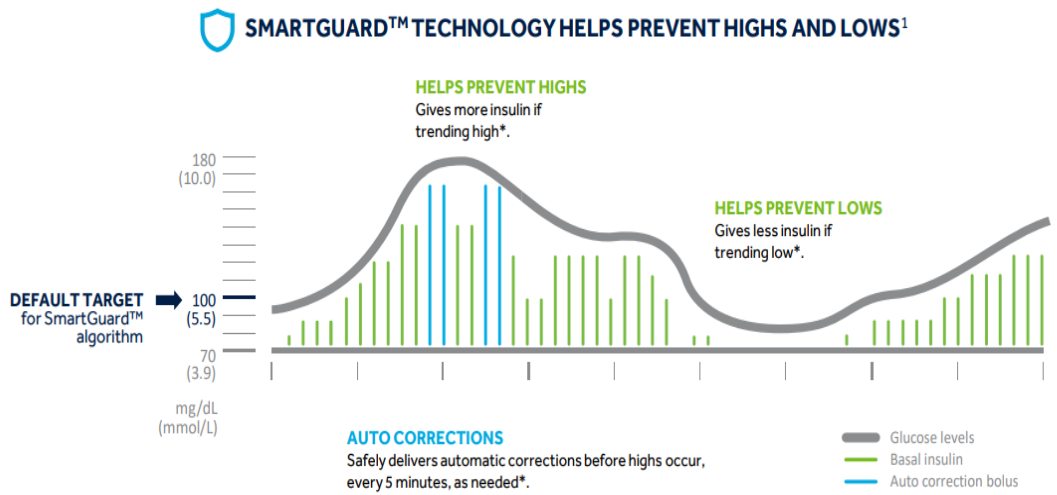
Individualized transmitter but same apps	
670G Guardian link 3 transmitter with Guardian 3 sensor -Connect by Radio-frequency between pump and transmitter	
780G Guardian link 3 transmitter with Guardian 3 sensor -Connect by Bluetooth between apps and transmitter	
780G Guardian 4 transmitter with Guardian 4 sensor -Connect by Bluetooth between apps and pump, pump and transmitter	

780G System with G4 sensor:

Glucose variability: each day and night, insulin needs vary

Carb counting: burdensome of diabetes self-care

Correction boluses: lack of correction boluses &/inaccurate correction boluses



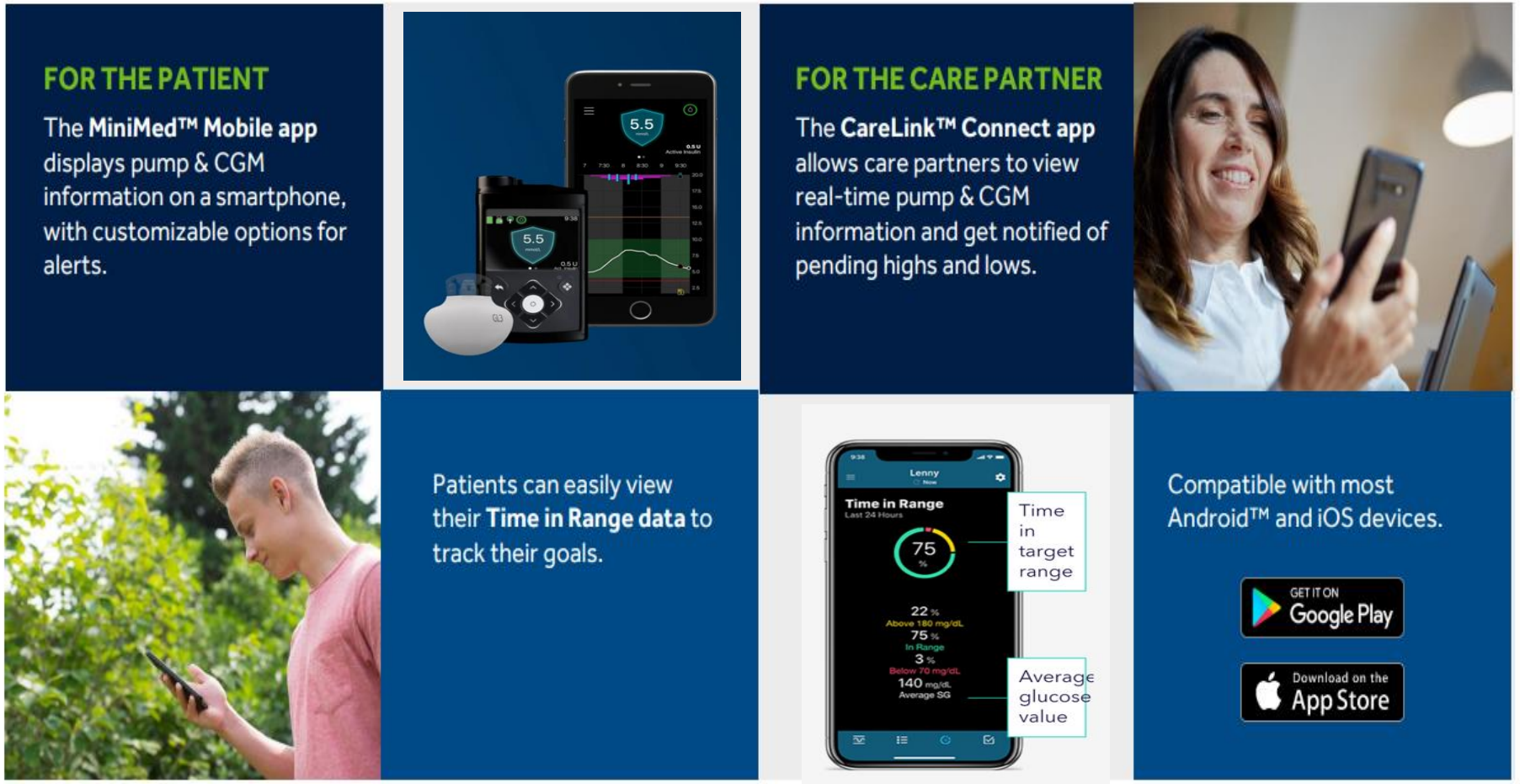
Special features:

1. Auto basal: determines an individual's real-time needs and automatically adjusts delivery every 5 minutes to stabilize glucose

2. New: Auto corrections safely deliver gradual correction boluses every 5 minutes, as needed

3. New: Lower default target (5.5 mmol/L) with options to select higher targets of 6.1 or 6.7 mmol/L. Designed and safely tested with Active insulin time of 2-3 hours

Smartphone connectivity for Greater convenience and peace of mind



Guardian 4 sensor

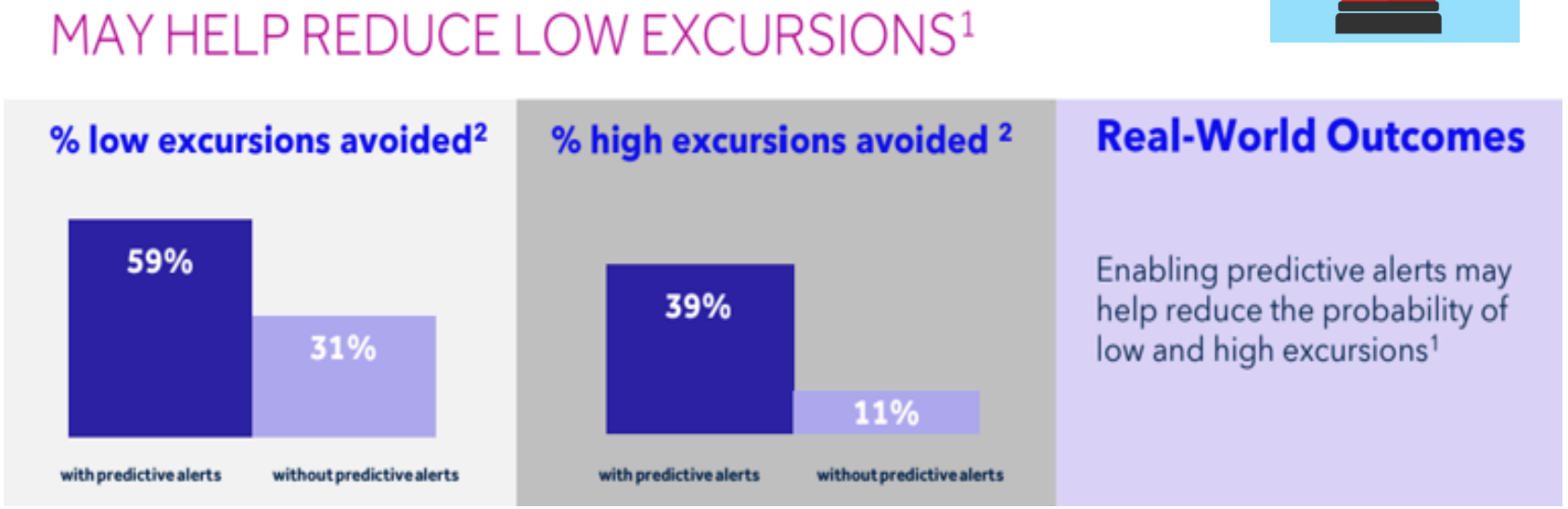


- Do not need fingerstick calibration
- Start-up time: 2 full hours
- Accuracy: Required by AI system to enter BG value
- Users can bolus insulin based on CGM reading alone without having to perform a confirmatory fingerstick
- Urgent low (Mandatory setting for patient safety): 3.0

=> The Guardian Connect system is the only CGM system with customizable predictive alerts that helps you outsmart both highs and lows

Predictive alert: up to 60 minutes before a low or high





Study method:

Continuous glucose monitoring system data uploaded between January 2, 2017 and May 22, 2018 by 3133 individuals using MDI or CSII therapy were identified respectively analyzed.

Glucose excursions were defined as SG values that went beyond a preset low or high SG threshold for ≥ 15 minutes. Low SG threshold limit (3.9 mmol/L) and the high SG threshold limit (11.7 mmol/L) preset for all system users.

Home screen of Smartphone

For CGMS



For CSII



Trend Arrows Indicate Rate of Glucose Change



↓ ↑ Sensor Glucose (SG) has been rising or falling by about 1-2 mmol/L (20 – 40 mg/dL) over the last 20 minutes

↓↓ ↑↑ SG has been rising or falling by about 2-3 mmol/L (40 - 60 mg/dL) over the last 20 minutes

↓↓↓ ↑↑↑ SG has been rising or falling greater than 3 mmol/L (60 mg/dL) over the last 20 minutes

Adjusting Doses Based on Screen Data

If glucose is **low** before food intake:

- Do not bolus while glucose is low
- Treat the hypoglycemia
- Once glucose is within target, calculate the bolus for the meal. If arrows are present, adjust dose.

Bolus Adjustment Using Trend Arrows	
No Arrows	No Change in Dose
↓	Decrease by 10%
↓↓ OR ↓↓↓	Decrease by 20%

If glucose is **at or above** target before a meal:

- Check for trend arrows
- Calculate the bolus for the meal using guidelines below.

Bolus Adjustment Using Trend Arrows	
No Arrows	No Change in Dose
↑	Increase by 10%
↑↑ OR ↑↑↑	Increase by 20%

Medtronic

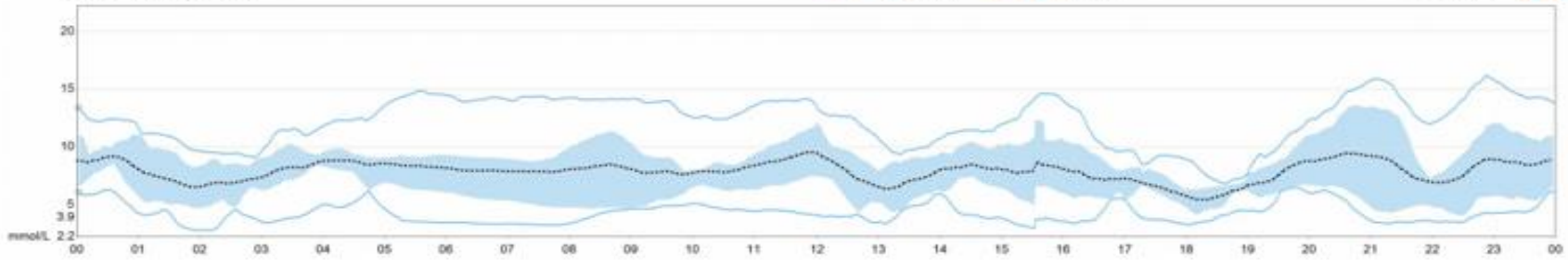
Medtronic

Assessment and Progress
A 31/3/2023 - 7/4/2023 (8 Days)
B Unavailable

X, XX

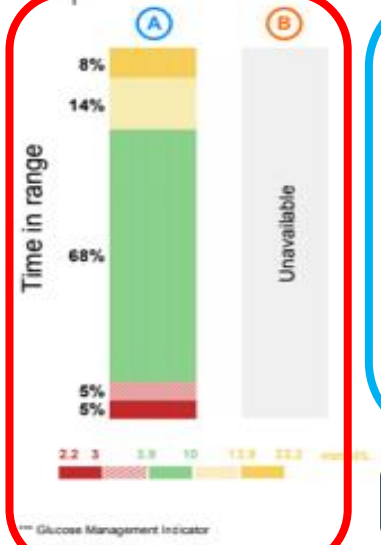
Generated: 15/5/2023, 11:55 **Page 1 of 16**
Data Sources: Guardian™ 4 system (GCMC2R-N5NV-A0DF-G2F3)

Percentile comparison — 25-75% — 5-95% — Average (A)



(A) Hypoglycemic patterns (0) — # Episodes (per day): 1.6 — None

Hyperglycemic patterns (0) — # Episodes (per day): 2.1 — None



Statistics	A	B
Sensor Wear (per week)	87% (6d 03h)	--
Average SG ± SD	7.9 ± 3.3 mmol/L	--
GMI***	--	--
Coefficient of Variation (%)	42.1%	--
Low / High SG Alerts (per day)	6.1 / 0.0	--
Average BG	3.2 mmol/L	--
BG / Calibration (per day)	0.1 / 0.0	--
Total daily dose (per day)	32.9 units	--
Bolus amount (per day)	--	--
Basal amount (per day)	--	--
Meal (per day)	1.6	--
Carbs entered (per day)	85 ± 83 g	--

Settings	A	B
Alert on High (Day/Night)	Off/Off	--
Alert before High (Day/Night)	Off/Off	--
Time before High (Day/Night) Hr	--/--	--
Alert on Low (Day/Night)	On/On	--
Alert before Low (Day/Night)	On/On	--
Time before Low (Day/Night) Hr	0:20/0:20	--

CGM Alert Settings

Sensor, Insulin + Meals Stats

This report is compatible with the Ambulatory Glucose Profile calculations used by the International Diabetes Center

Time in range

Note: Insulin and meal data require patients to log that data in the app.

Inpen smart insulin pen system



- A one-year, reusable, Bluetooth-enabled smart insulin pen
- Automatically captures mealtime doses and keeps track of insulin on board (how much insulin is still active inside your body from the previous bolus)
- The Inpen smartphone app (available for iOS and Android) tracks insulin doses and glucose levels, includes a bolus calculator and creates an InPen Insights report that combines glucose and insulin data for reviewing
- Is the only smart insulin pen approved in the US or Europe that integrates with real-time CGM data

Inpen™ smart Insulin pen system for Insulin management

Key features - the InPen smart insulin pen

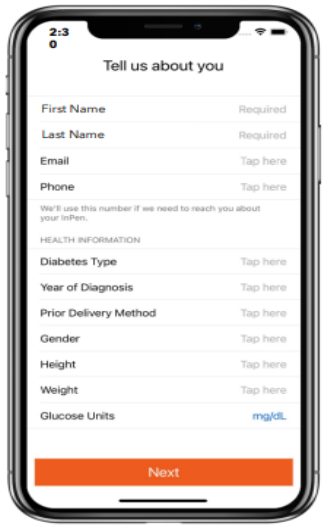


- Share data from multiple InPens devices to the same app
- Connects to the app via Bluetooth®
- Compatible with NovoRapid®, Humalog®, and Fiasp® cartridges
- Monitors insulin temperature
- Battery lasts a full year with no need to charge
- Delivers half unit doses

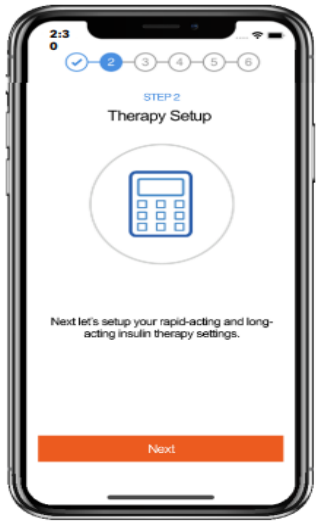
User Setup Wizard

Resources: InPen Training Guide for HCP & Training Checklist

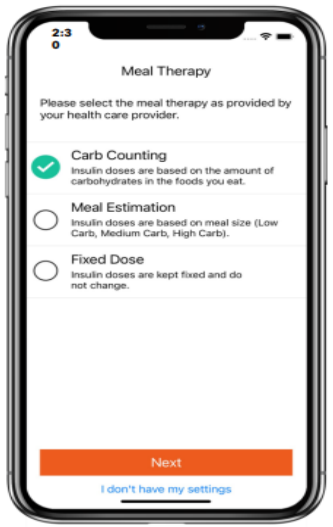
About You



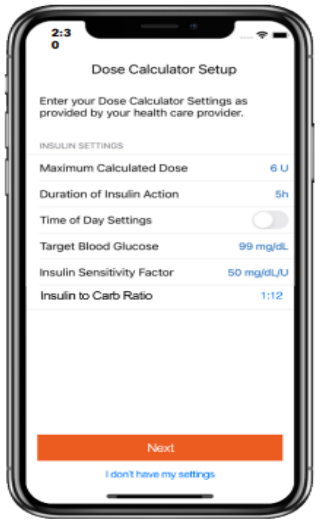
Therapy Setup



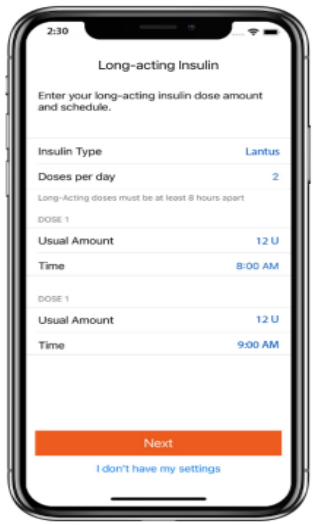
Dose Calculator



Therapy Settings

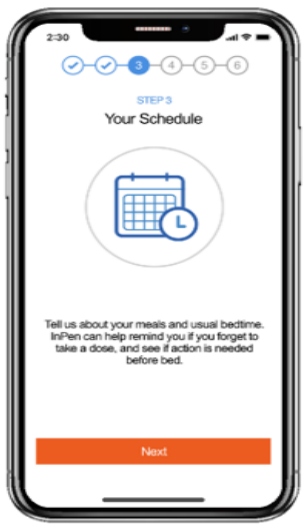


Long-acting Insulin

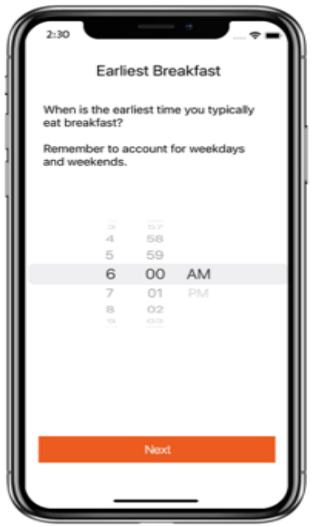


Important: Dose calculator requires therapy settings provided by HCP. Patients should NOT calculate their own settings.

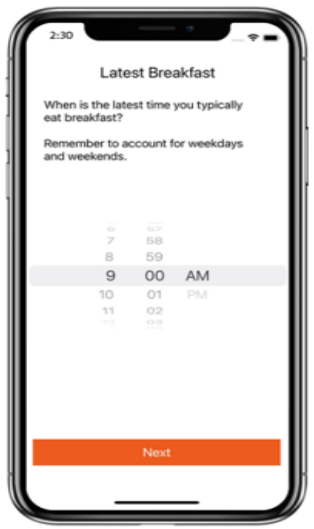
Your Schedule



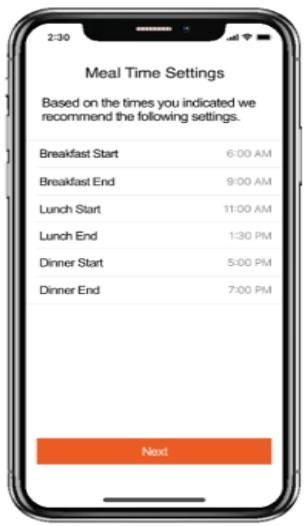
Earliest Breakfast



Latest Breakfast



Meal Time Settings



Your schedule will dictate when the app sends missed dose reminders

Home screen

The Home screen is your primary therapy dashboard



Launch Dose Calculator

Current Glucose

Trend Graph

Daily Timeline

Shows amount and visual shading of how much insulin is still active from that dose

- Carbs are green
- Glucose is purple
- Insulin is blue

Active Insulin (if enabled)

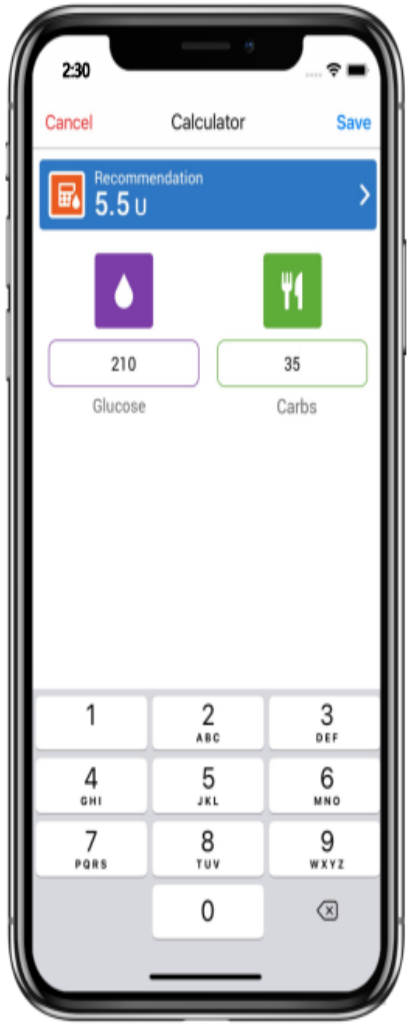
Notification Icons

Settings

Dose calculator

InPen automatically tracks insulin doses in the app

- Recommends dose based on:
  1. Current glucose
  2. Carbohydrates or meal information
  3. Active insulin
- Helps to reduce stacking, by accounting for active insulin
- Utilizes Bluetooth® meters
- Recommends carbohydrates to avoid potential lows

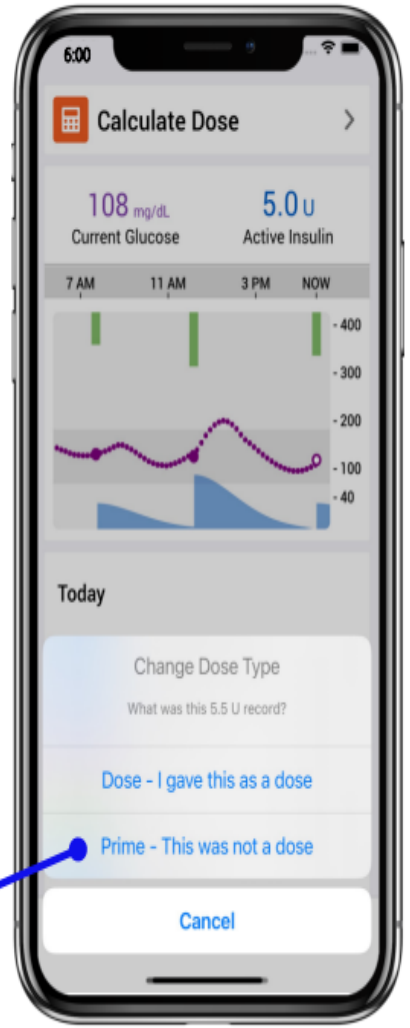


Medtronic

Priming vs dosing

User should prime the pen needle before each therapeutic dose

- Priming dose: insulin pushed through needle before administering therapeutic dose
  - Required by all insulin pens
- Only therapeutic doses will be included in active insulin and TDD
- InPen algorithm detects whether dose is a "prime" or "therapeutic"
  - Doses given 1.5s apart: first dose logged as prime
  - Last dose in 2-minute window is therapeutic
  - First dose after cartridge replacements is marked as prime
- All manual doses are considered therapeutic

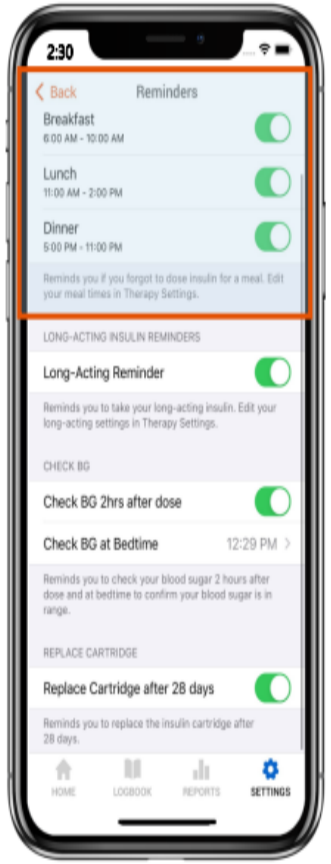


Users can adjust if dose is marked as prime or therapeutic in the logbook

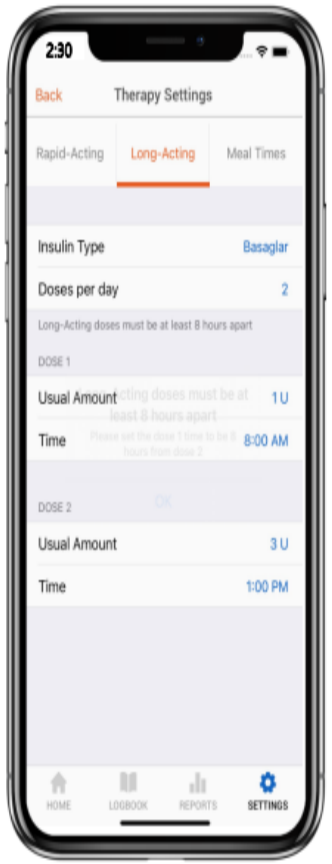
Medtronic

Types of reminders

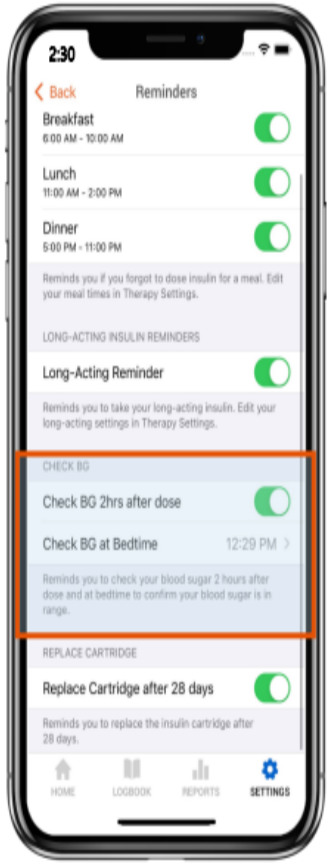
Missed Meal Dose



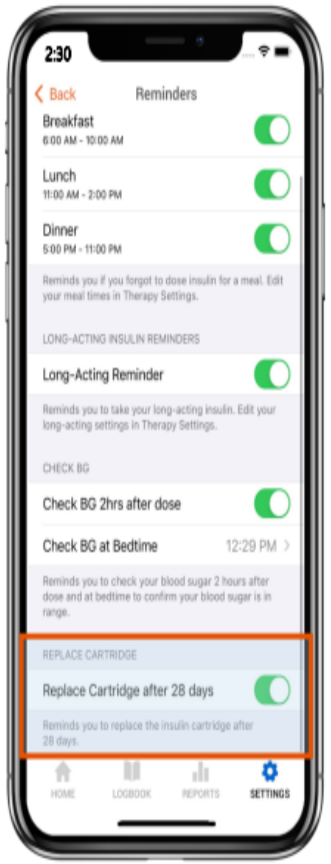
Missed Long-Acting



Check BG Reminder



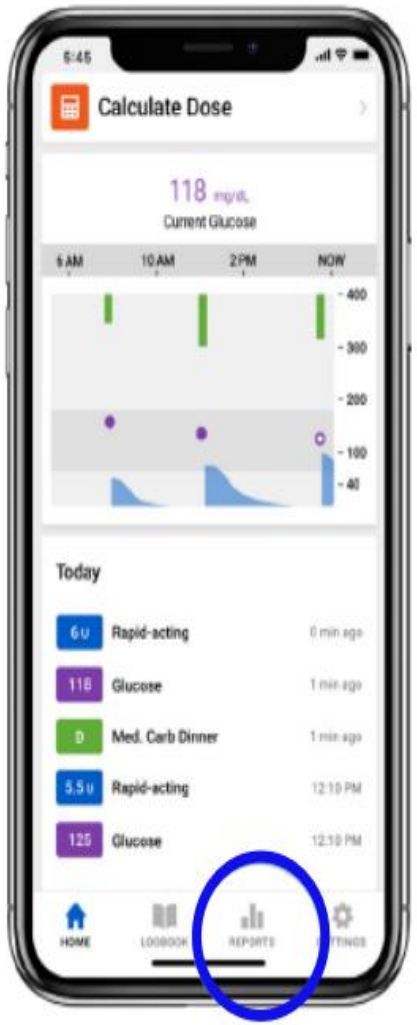
Replace Cartridge



Reminders may help adherence to a diabetes treatment plan

Generating reports

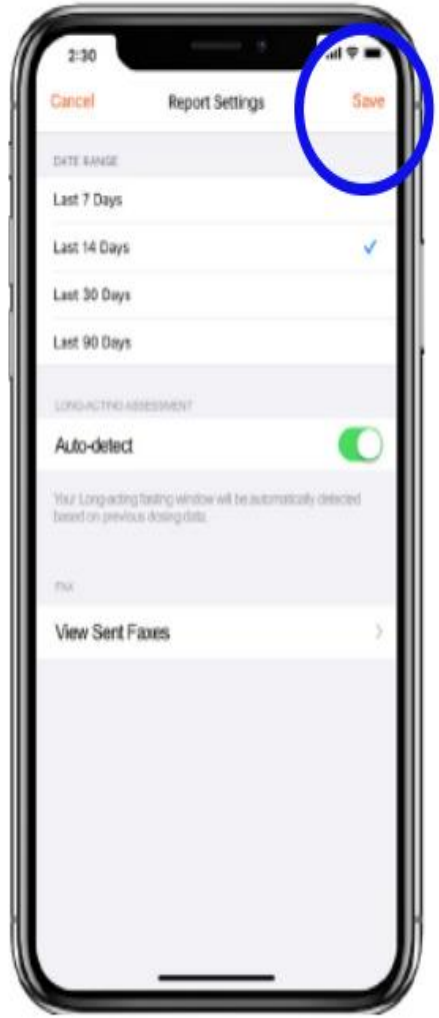
Choosing a date range



Tap Reports



Tap the Gear Icon



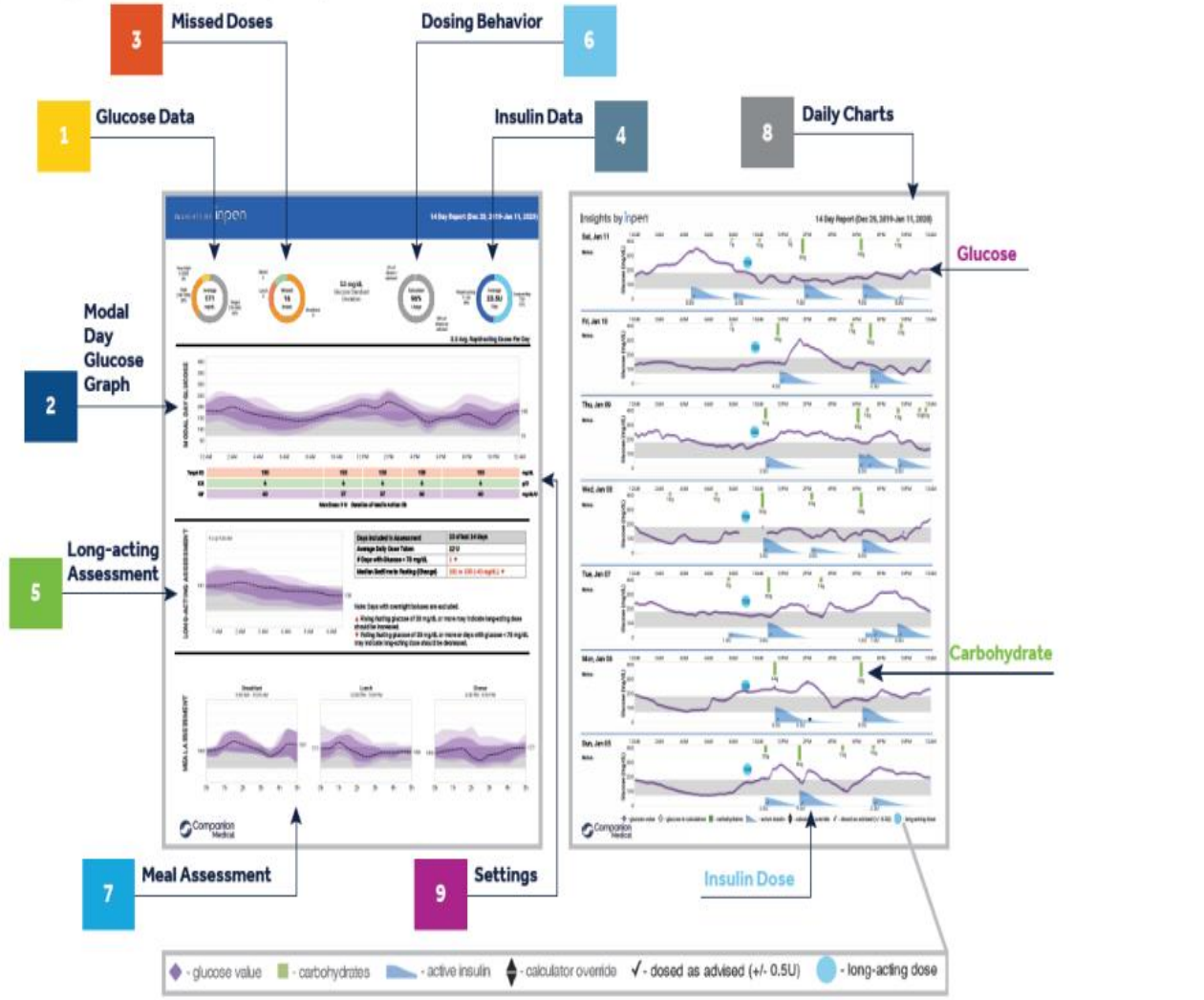
Select Date Range & Save

Screenshots not final

Medtronic

Insights Report

Resources: Reference Guide to Insights by InPen Reports



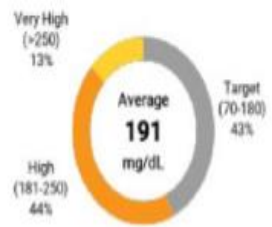
Medtronic

Report Overview

Important statistics about your diabetes management

Glucose Overview

- Average glucose
- % Time in Range
- Hypoglycemia
- Hyperglycemia



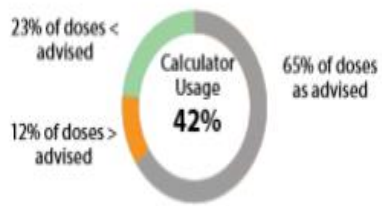
Missed Doses

- Reports how often doses are missed at particular times of day
- Adjust mealtimes in InPen app
- Set up dose reminders



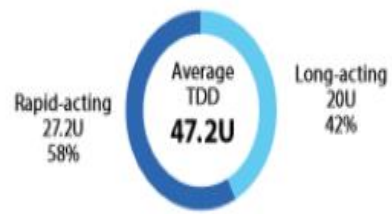
Dosing Behavior

- % of time dose calculator is used
- How often the dose amount is adjusted



Insulin Data

- Average total daily dose
- Basal/bolus balance with insulin overview



Statistics provide quick insights into overall insulin

Case Sharing

CGM – Empowerment tool

- Wearing a CGM alone will **not** improve blood glucose
- Patient education and engagement
    1. Realistic goals and emotional support – type 1 vs type 2
    2. Sensor glucose vs blood glucose
- Calibration if necessary
- CGM display information
- Cross checking glucose when hypo and extremely hyper
- Crucial information – SMBG readings, food intake, physical activity, medication and dose, events such as hypo symptoms, stress and illness

Case 1 – Mr. Cheung 33/M

- Airport security guard on night shift with OT at most of time around 10pm
- T2DM since 2015, FU GOPD on Met/SU
- Obesity
  Hyperlipidemia on Zocor
  Hba1c 9.7 (11/2019) ->12 (3/2020)
- Pio 15mg, metformin 1g bd, Ryzodec 6/28, Bydureon 2mg weekly

Empowerment Tool

30 June 2020 - 13 July 2020 (14 Days)

GLUCOSE STATISTICS AND TARGETS

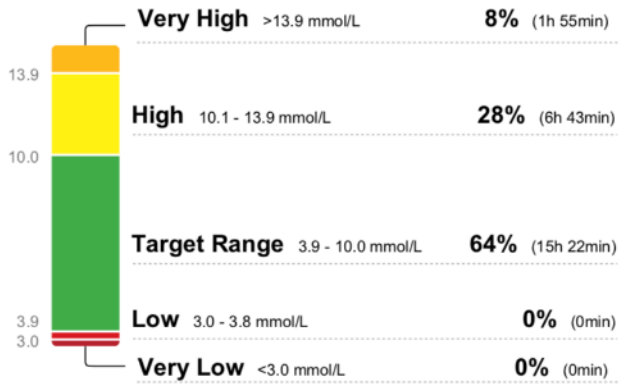
30 June 2020 - 13 July 2020	**14 Days**
% Time Sensor is Active	**97%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

Average Glucose	**9.6** mmol/L
Glucose Management Indicator (GMI)	**7.4% or 58 mmol/mol**
Glucose Variability	**27.1%**

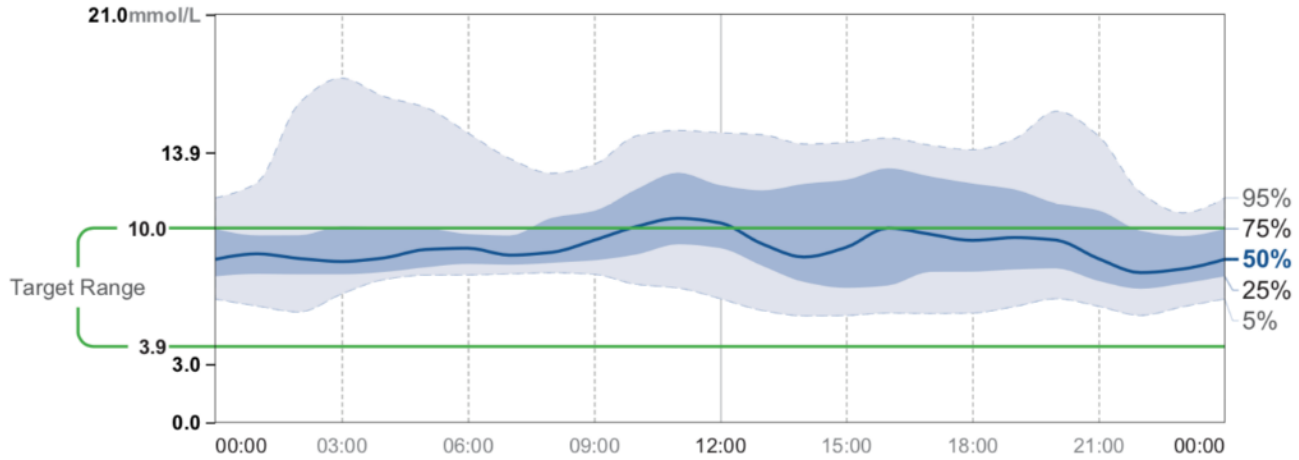
Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



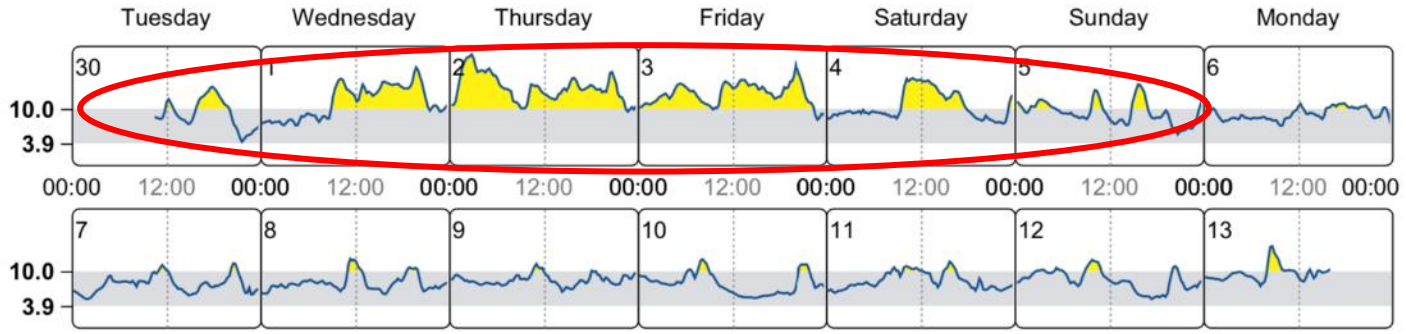
AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



DAILY GLUCOSE PROFILES

Each daily profile represents a midnight to midnight period with the date displayed in the upper left corner.



Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetes Association, 7 June 2019, https://doi.org/10.2337/dci19-0028.

Behavior Modification

GLUCOSE STATISTICS AND TARGETS

25 July 2020 - 7 August 2020 — **14 Days**

- **% Time Sensor is Active** — **97%**

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)
Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.	

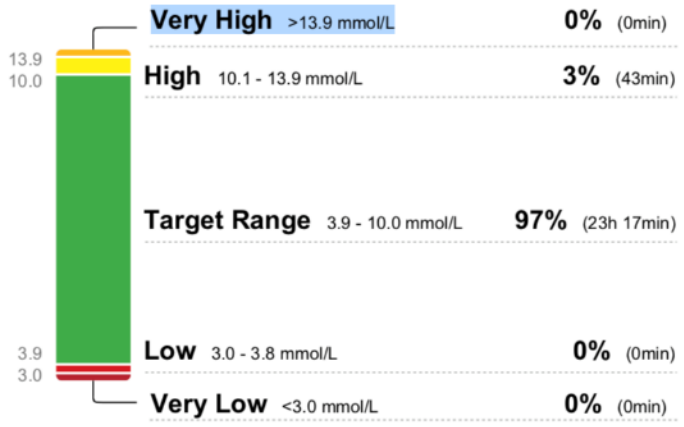
Average Glucose — **6.7** mmol/L

Glucose Management Indicator (GMI) — **6.2% or 44 mmol/mol**

Glucose Variability — **22.4%**

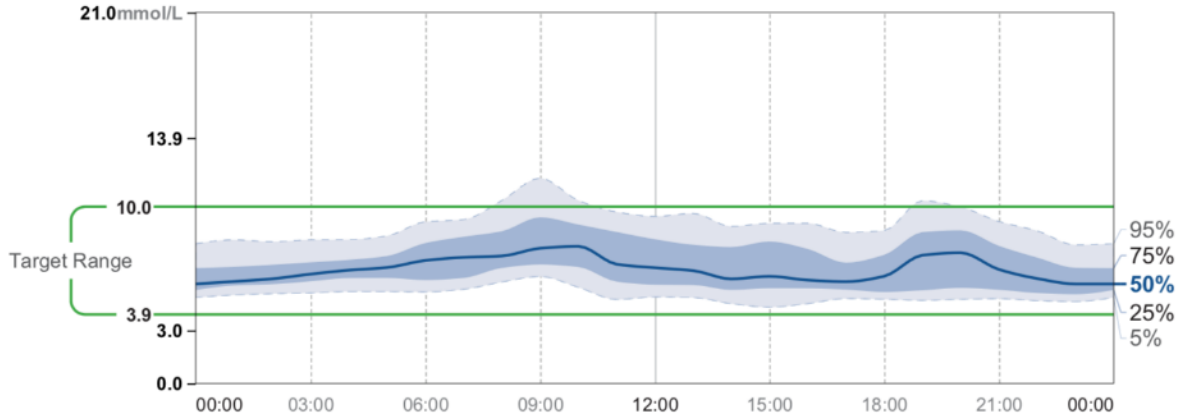
Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES



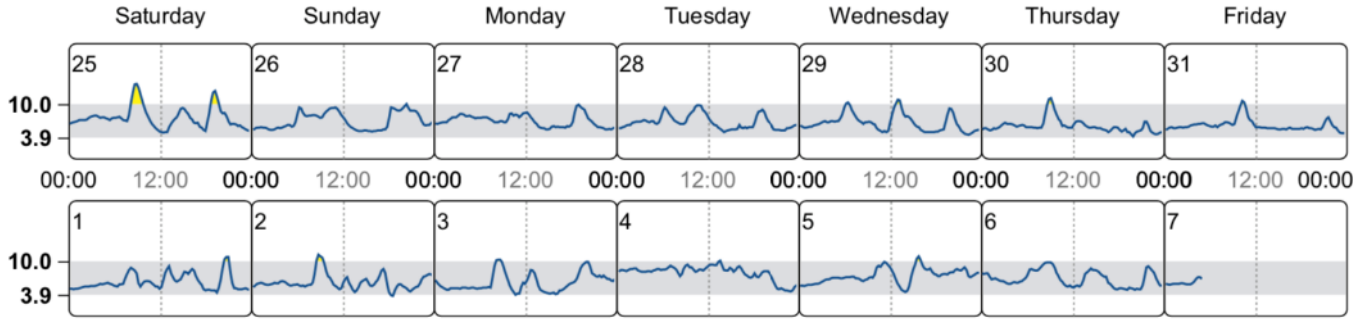
AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.



DAILY GLUCOSE PROFILES

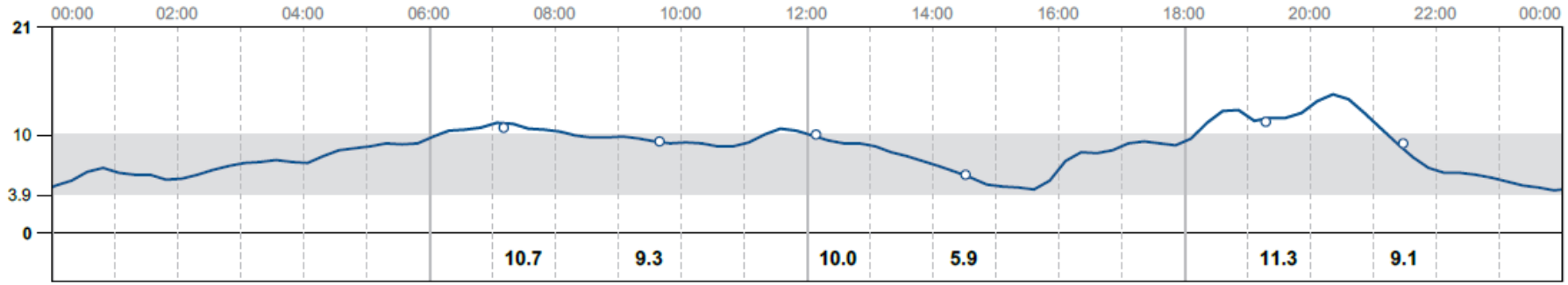
Each daily profile represents a midnight to midnight period with the date displayed in the upper left corner.



Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetes Association, 7 June 2019, https://doi.org/10.2337/dci19-0028.

TUE 3 Aug

Glucose mmol/L

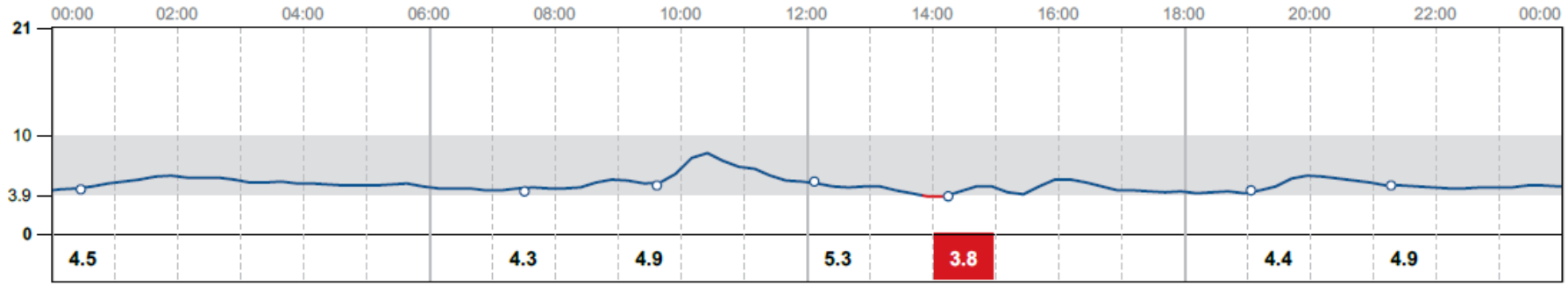


Notes

- 10.6
- 皮蛋瘦肉粥
- 皮蛋瘦肉粥
- 蟹柳炒蛋炒雜菜半碗飯
- 兩個眉豆茶果

WED 4 Aug

Glucose mmol/L

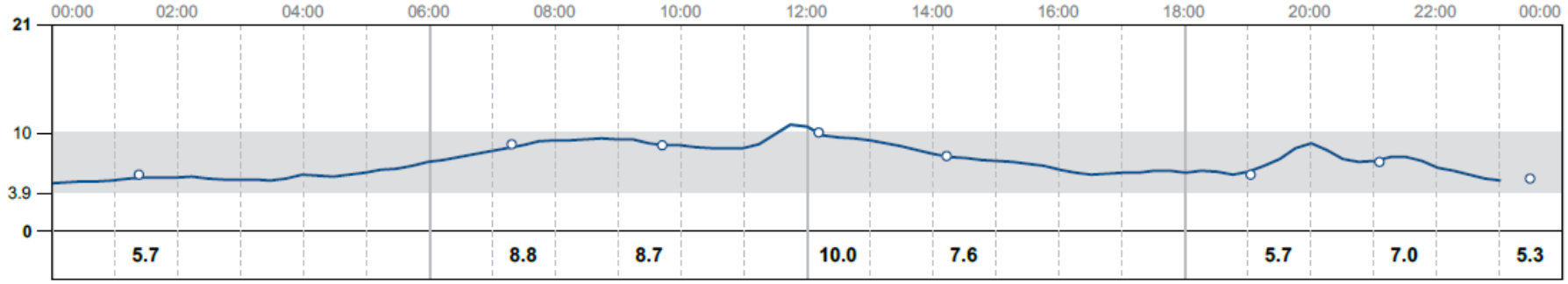


Notes

- 5.4
- 一包鈣思寶豆奶
- 5.3半盒鳳爪排骨飯
- 10粒韭菜餃一碗椰菜花

THU 5 Aug

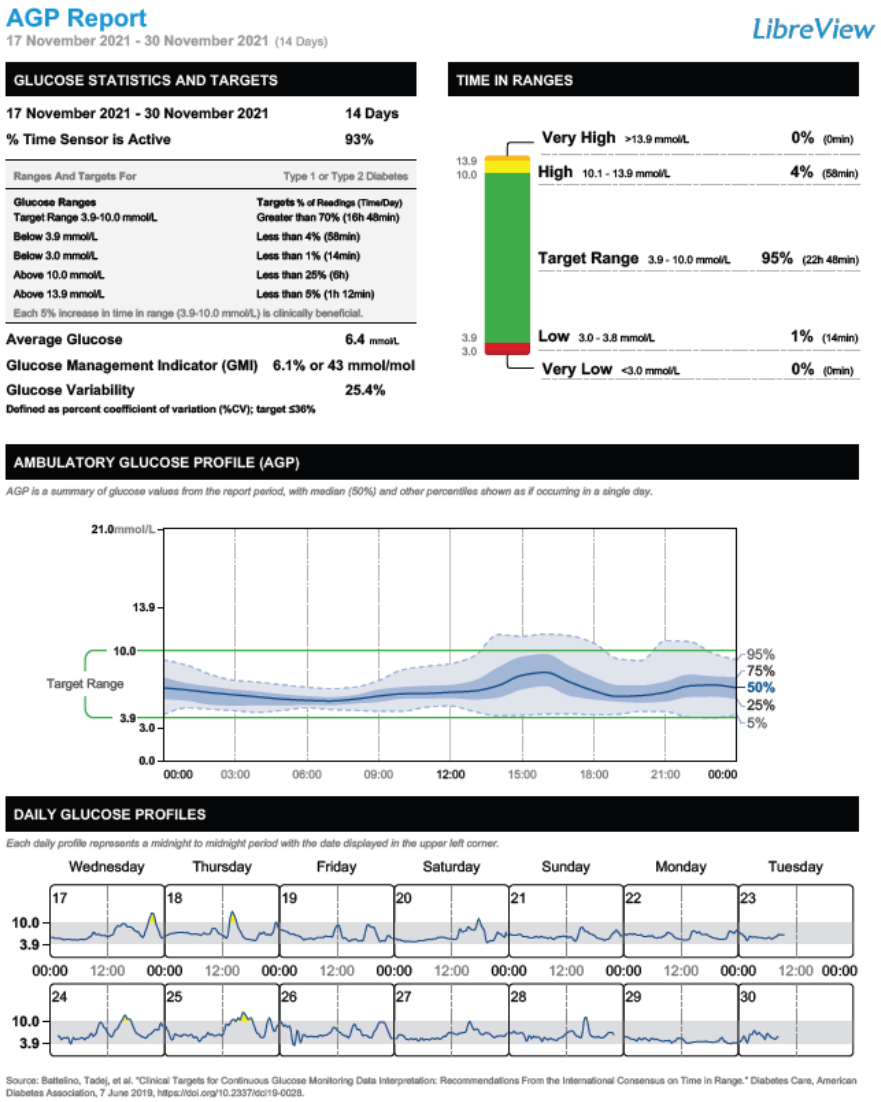
Glucose mmol/L



Notes

- 8.8
- 榨菜肉絲米粉
- 一碗椰菜花10粒椰菜餃子10粒八爪魚丸
- 冬瓜瘦肉湯半碗飯西芹炒蝦仁

Report Interpretation



AGP Report
17 November 2021 - 30 November 2021 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

17 November 2021 - 30 November 2021	14 Days
% Time Sensor is Active	93%

Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	Targets % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)

Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose	6.4 mmol/L
Glucose Management Indicator (GMI)	6.1% or 43 mmol/mol
Glucose Variability	25.4%

Defined as percent coefficient of variation (%CV); target ≤36%

TIME IN RANGES

Very High	>13.9 mmol/L	0% (0min)
High	10.1 - 13.9 mmol/L	4% (58min)
Target Range	3.9 - 10.0 mmol/L	95% (22h 48min)
Low	3.0 - 3.8 mmol/L	1% (14min)
Very Low	<3.0 mmol/L	0% (0min)

AMBULATORY GLUCOSE PROFILE (AGP)

AGP is a summary of glucose values from the report period, with median (50%) and other percentiles shown as if occurring in a single day.

21.0mmol/L, 13.9, 10.0, Target Range, 3.9, 3.0, 0.0
95%, 75%, 50%, 25%, 5%
00:00 03:00 06:00 09:00 12:00 15:00 18:00 21:00 00:00

DAILY GLUCOSE PROFILES

Each daily profile represents a midnight to midnight period with the date displayed in the upper left corner.

Wednesday 17, Thursday 18, Friday 19, Saturday 20, Sunday 21, Monday 22, Tuesday 23
Sunday 24, Monday 25, Tuesday 26, Wednesday 27, Thursday 28, Friday 29, Saturday 30
10.0, 3.9, 00:00 12:00

Source: Battelino, Tadej, et al. "Clinical Targets for Continuous Glucose Monitoring Data Interpretation: Recommendations From the International Consensus on Time in Range." Diabetes Care, American Diabetes Association, 7 June 2019, https://doi.org/10.2337/dci19-0028.

Case 2 - Ms Ko 52/F

Type 2 DM since 2010
Strong family history of DM
Pancreatitis
Hyperlipidemia

> high TG 11.2
On Fenofibrate / Niaspan / Omega 3 / Crestor

On Diamicron MR + Januvia
Started insulin at 2016 as HbA1c 8%
Current: Ryzodeg 14u om and 4u dinner

>> Ryzodeg 14u om

Daily Log

17 November 2021 - 30 November 2021 (14 Days)

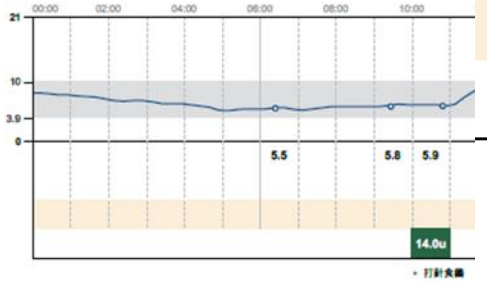
LibreView



Daily Log

17 November 2021 - 30 November 2021 (14 Days)

FRI 19 Nov

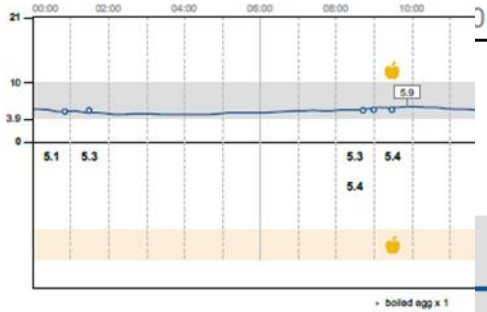


4.7 4.9 5.2

14.0u

- 打針食藥
- 飲茶 燒賣 小籠包 韭菜豬紅
- 餐蛋出前一丁 魚柳薯餅 熱檸水
- Exercise
- bicycle

SAT 20 Nov



10:00 12:00 14:00 16:00 18:00 20:00 22:00 00:00

5.9 8.8 6.5

5.3	5.4		5.4	5.4	7.6	7.8	7.8	3.9	4.9	5.6	7.2
5.4			5.2	8.8						7.4	6.6
											6.5

14.0u

- boiled egg x 1
- 打針食藥
- Exercise
- peanut
- 飲茶：鮑魚雞絲腸，煎蘿蔔糕，蝦餃，粉果，釀茄子， 煎腐皮卷

Hypoglycemia management

KWONG YIK TSANG MRN: _____ UCH DACC PAGE: 1 / 1

DOB: 25/07/1947 DEVICE: FreeStyle LibreLink PHONE: Generated: 14/03/2023

AGP Report

1 March 2023 - 14 March 2023 (14 Days)

LibreView

GLUCOSE STATISTICS AND TARGETS

1 March 2023 - 14 March 2023	14 Days
% Time Sensor is Active	95%

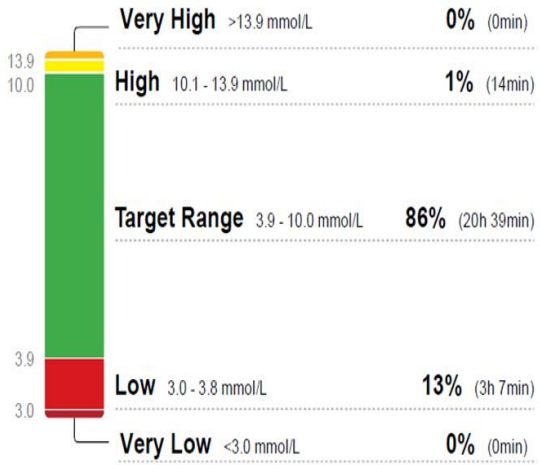
Ranges And Targets For	Type 1 or Type 2 Diabetes
Glucose Ranges	**Targets** % of Readings (Time/Day)
Target Range 3.9-10.0 mmol/L	Greater than 70% (16h 48min)
Below 3.9 mmol/L	Less than 4% (58min)
Below 3.0 mmol/L	Less than 1% (14min)
Above 10.0 mmol/L	Less than 25% (6h)
Above 13.9 mmol/L	Less than 5% (1h 12min)

Each 5% increase in time in range (3.9-10.0 mmol/L) is clinically beneficial.

Average Glucose	5.8 mmol/L
Glucose Management Indicator (GMI)	5.8% or 40 mmol/mol
Glucose Variability	28.2%

Defined as percent coefficient of variation (%CV)

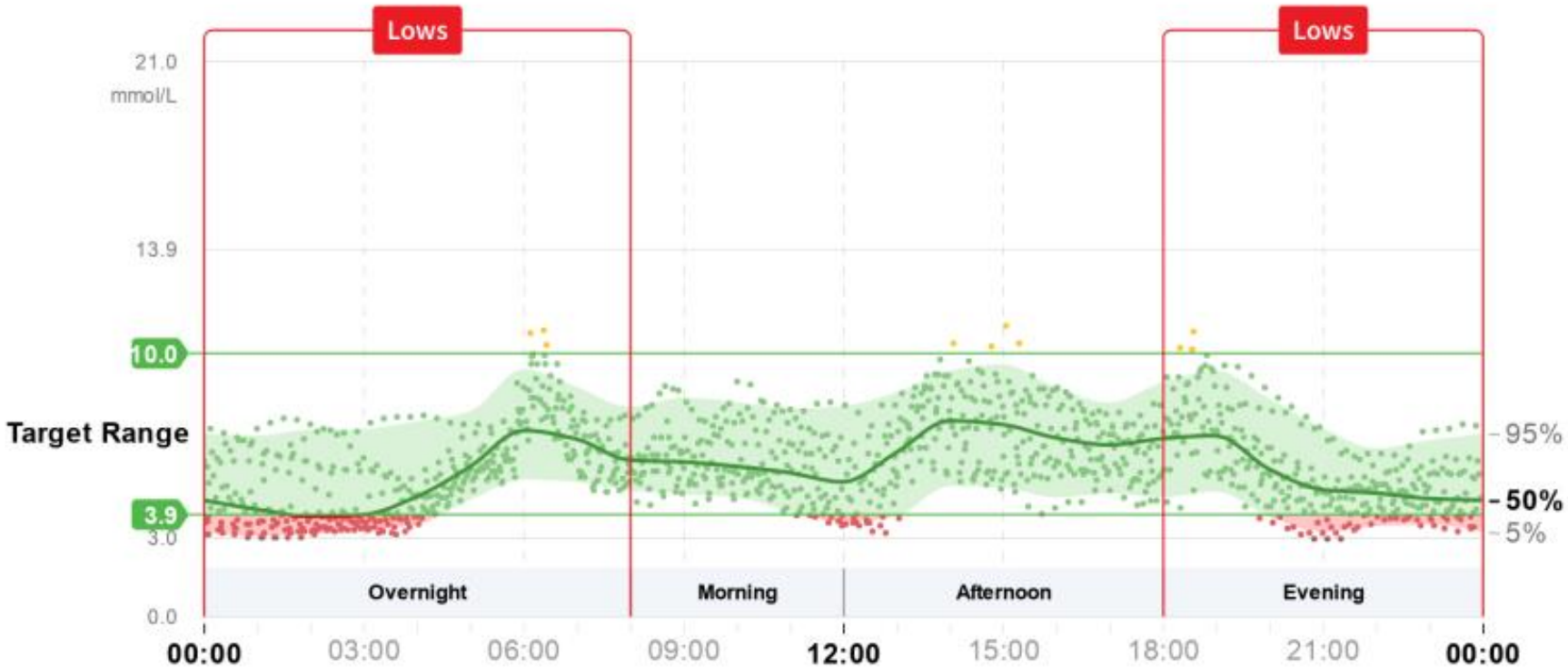
TIME IN RANGES



Case 3 – Mr. Tsang 75/F

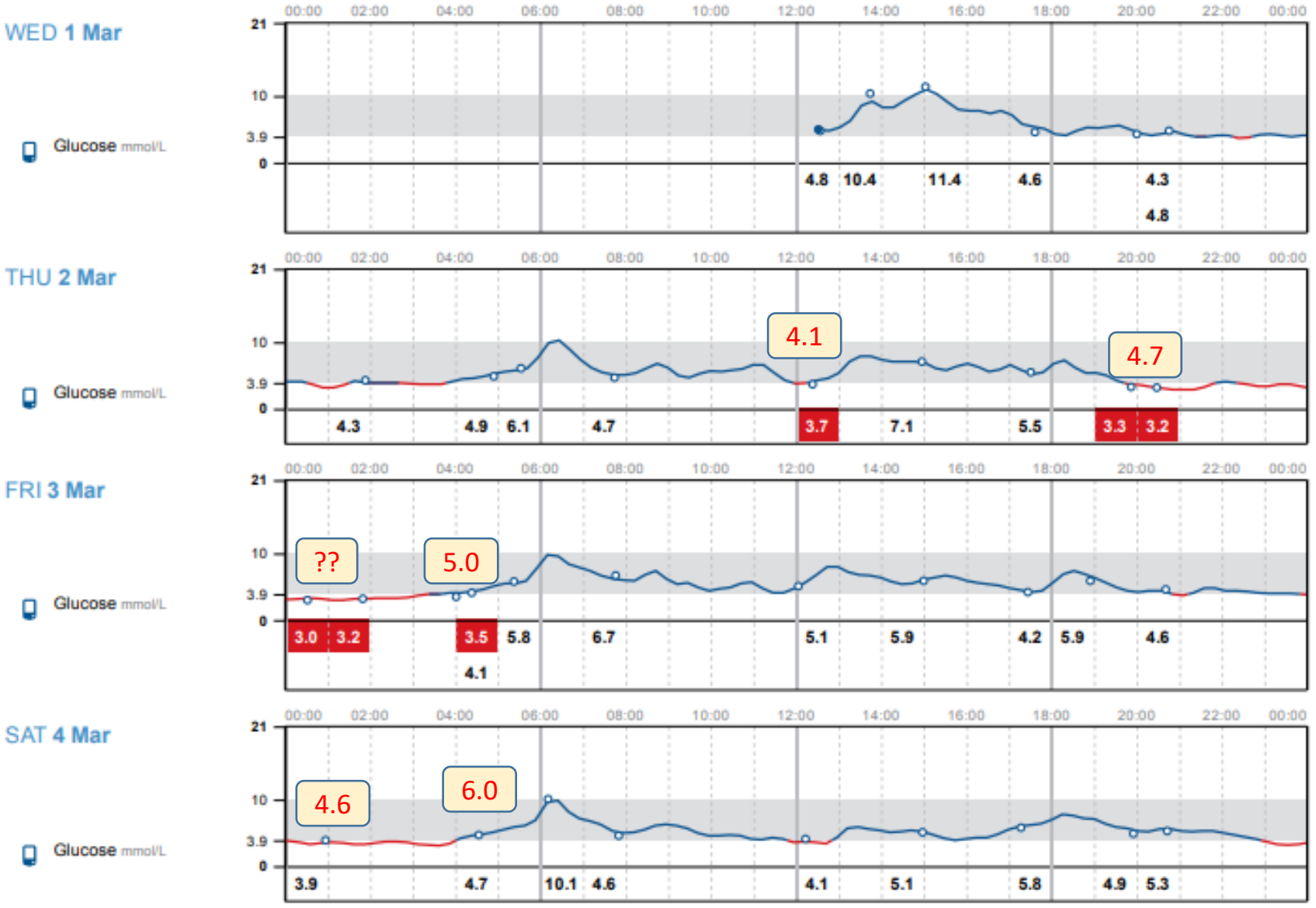
- Live alone
- DM since 1994 and started insulin in 2010
- HT and hyperlipidemia
- Chest pain FU Med, pending CT Coronary Angiogram 2024
- Reported hypo attack with symptom after breakfast in education program after MRAM
- Current regime: Protaphane 13u om, 8u nocte, diamicron 160mg om, 80mg pm, Actos 15mg daily, and Metformin 1g BD

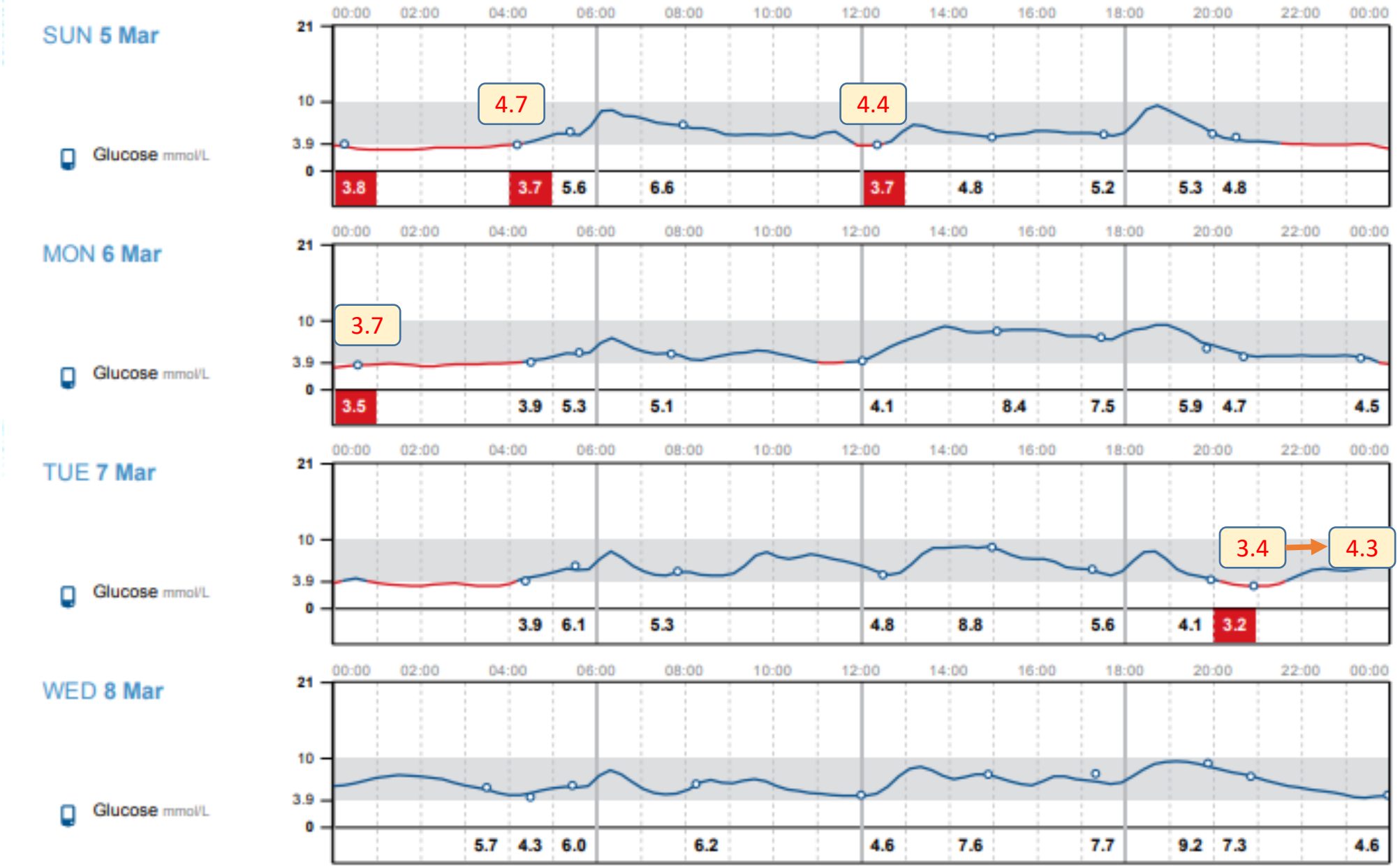
Glucose Patterns (14 Days)



Device(s): FreeStyle LibreLink

1. Suggested considerations do not replace the opinion or advice of the healthcare provider.


WED 1 Mar
Glucose mmol/L
00:00 02:00 04:00 06:00 08:00 10:00 12:00 14:00 16:00 18:00 20:00 22:00 00:00
21
10
3.9
0
4.8 10.4 11.4 4.6 4.3 4.8
THU 2 Mar
Glucose mmol/L
4.1
4.7
4.3 4.9 6.1 4.7 3.7 7.1 5.5 3.3 3.2
FRI 3 Mar
Glucose mmol/L
??
5.0
3.0 3.2 3.5 5.8 6.7 5.1 5.9 4.2 5.9 4.6
4.1
SAT 4 Mar
Glucose mmol/L
4.6
6.0
3.9 4.7 10.1 4.6 4.1 5.1 5.8 4.9 5.3
Legend
High Glucose (>13.9)
Low Glucose (<3.9)
Scans/Views
Logged
Post-Meal Peak
New Sensor
Time Change
17.0u 2.0 +0.0 15.0u Meal + Correction + User Change = Total
Strip Test



Reduced Protaphane 4 units nocte

KWONG YIK TSANG DOB: 25/07/1947

Glucose Pattern Insights

LibreView

Generated: 06/04/2023 Page: 1 of 1

Selected Dates: 24 Mar - 6 Apr 2023 (14 Days)

Time Sensor Active: 88%

Time in Ranges



Very High	>13.9 mmol/L	0%	6%
High	10.1 - 13.9	6%	Goal: 25%
Target	3.9 - 10.0	93%	>70%
Low	3.0 - 3.8	1%	1%
Very Low	<3.0	0%	<4%

Glucose Statistics

Average Glucose

7.0 mmol/L Goal: ≤8.6 mmol/L

Glucose Management Indicator (GMI)

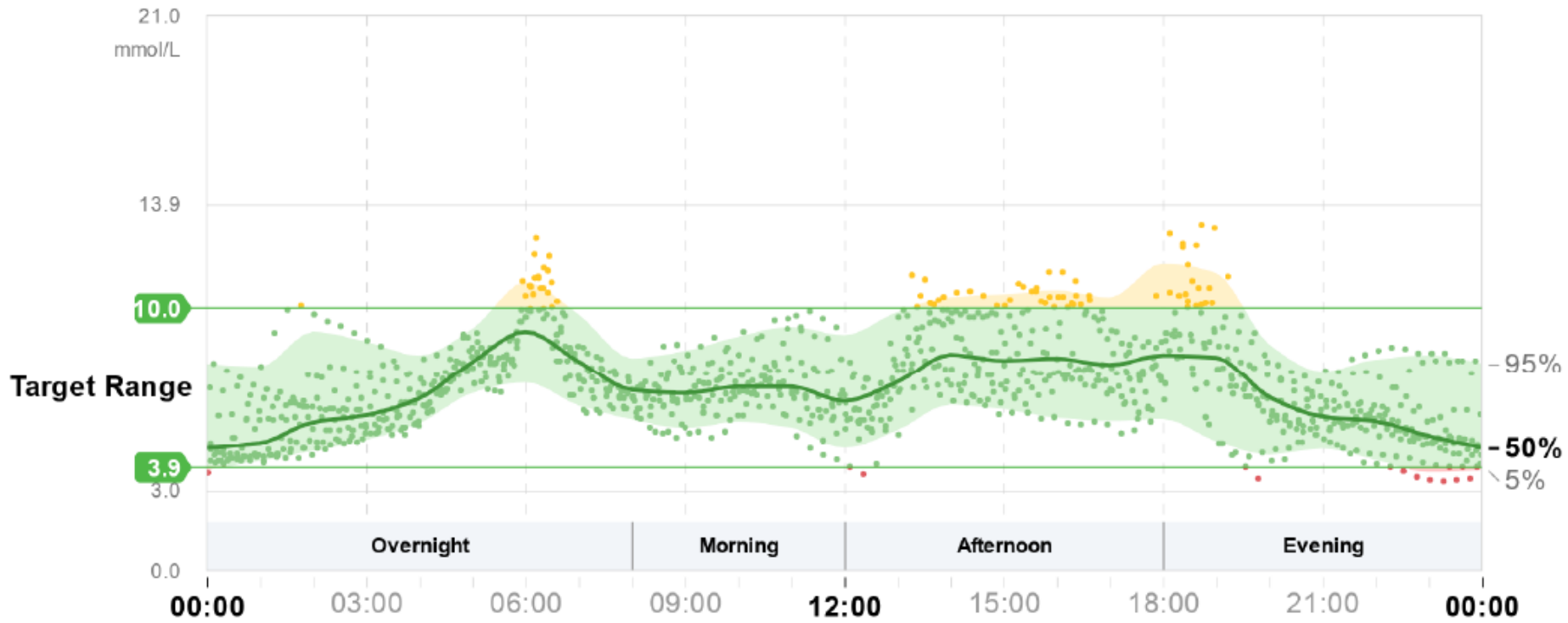
Approximate A1C level based on average CGM glucose level.

6.3% Goal: ≤7.0% | 46 mmol/mol Goal: ≤53 mmol/mol

Considerations for the Clinician[1]

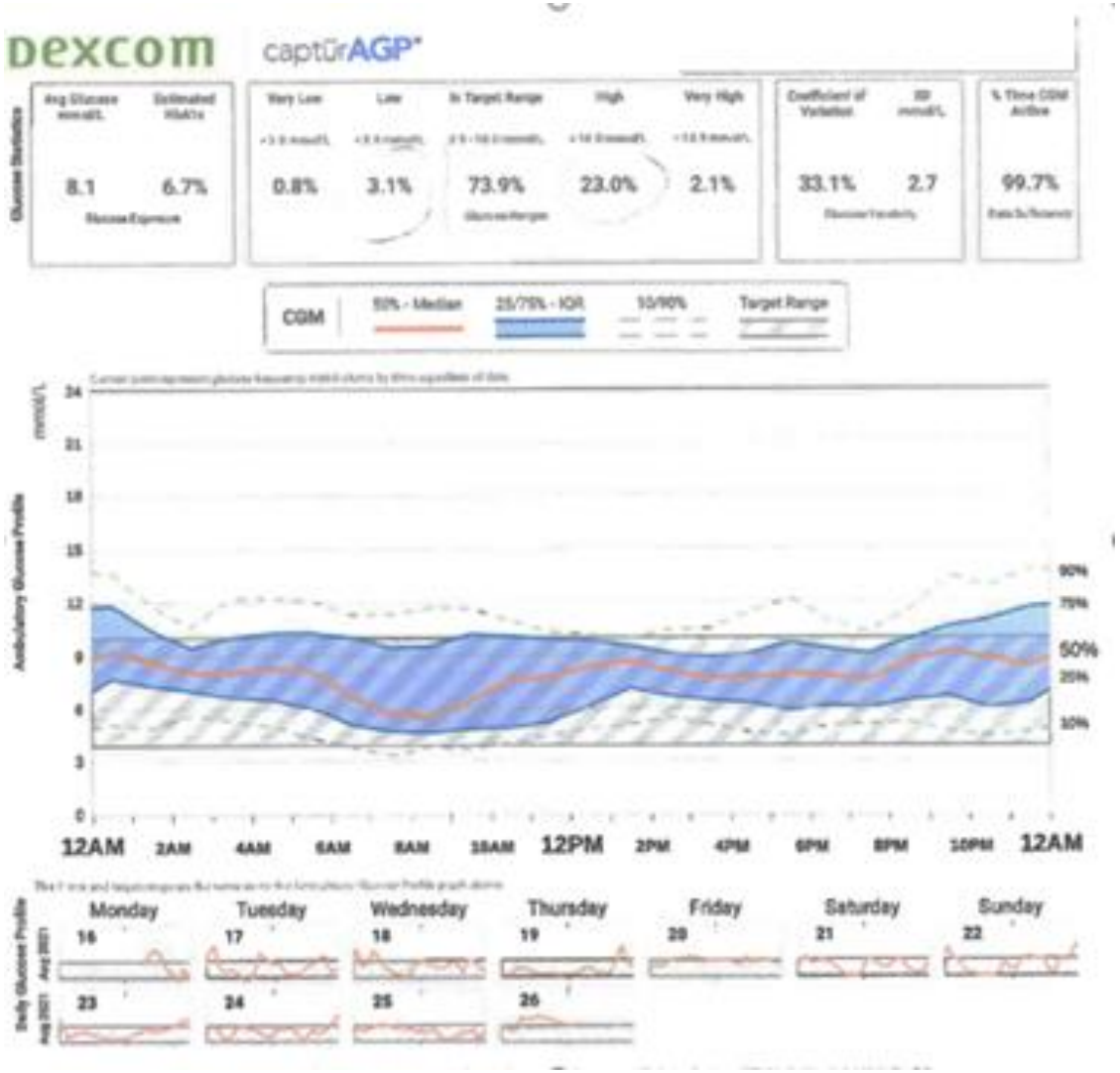
Most Important Pattern: No Adverse Glucose Patterns Detected

Glucose Patterns (14 Days)



HbA1c 6.3% (10/2022) > 6.6% (1/2023) > 6.4% (6/2023)

Behavior Information



Case 4 – Ms. Kowk 29/F

Past medical history

- T1D since 2008 with concomitant thyrotoxicosis (age 13) presented with poly symptoms and DKA
- Started Protaphane bed time and Atrapid before meals

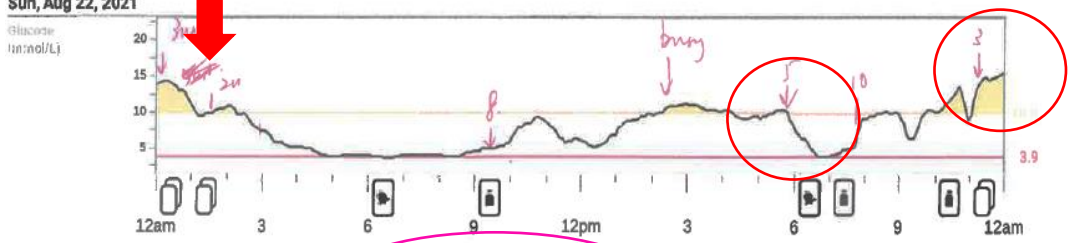
Progress of diabetes:

- Changed to Lantus and Novorapid since 2017
- HbA1c stable after adolescent 6.8% (12/2020), 6.7% (6/2021) with mild to moderate hypoglycemia 2 -3 time a week

Current: Lantus 13 units bedtime and Novorapid 5/6/8 units before 3 meals (TDD 32u)

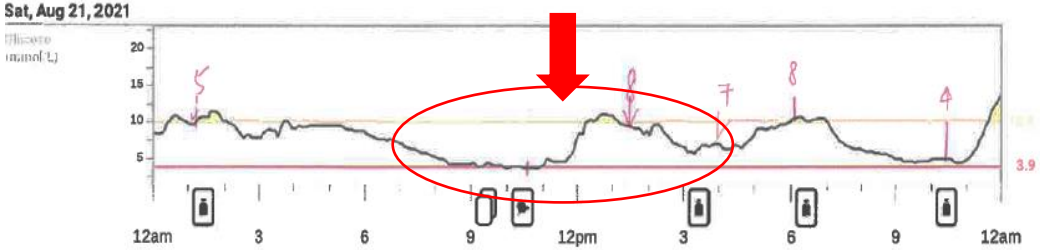
EXERCISE | MULTIPLE EVENTS

Sun, Aug 22, 2021



12:03 AM High	12:04 AM Fast-Acting 3 units	1:01 AM Fast-Acting 2 units	1:02 AM Long-Acting 10 units
6:23 AM Low	9:30 AM Fast-Acting 8 units	6:38 PM Urgent Low Soon	7:00 PM Fast-Acting 10 units
10:30 PM Fast-Acting 8 units	11:18 PM High	11:24 PM Fast-Acting 3 units	

Sat, Aug 21, 2021

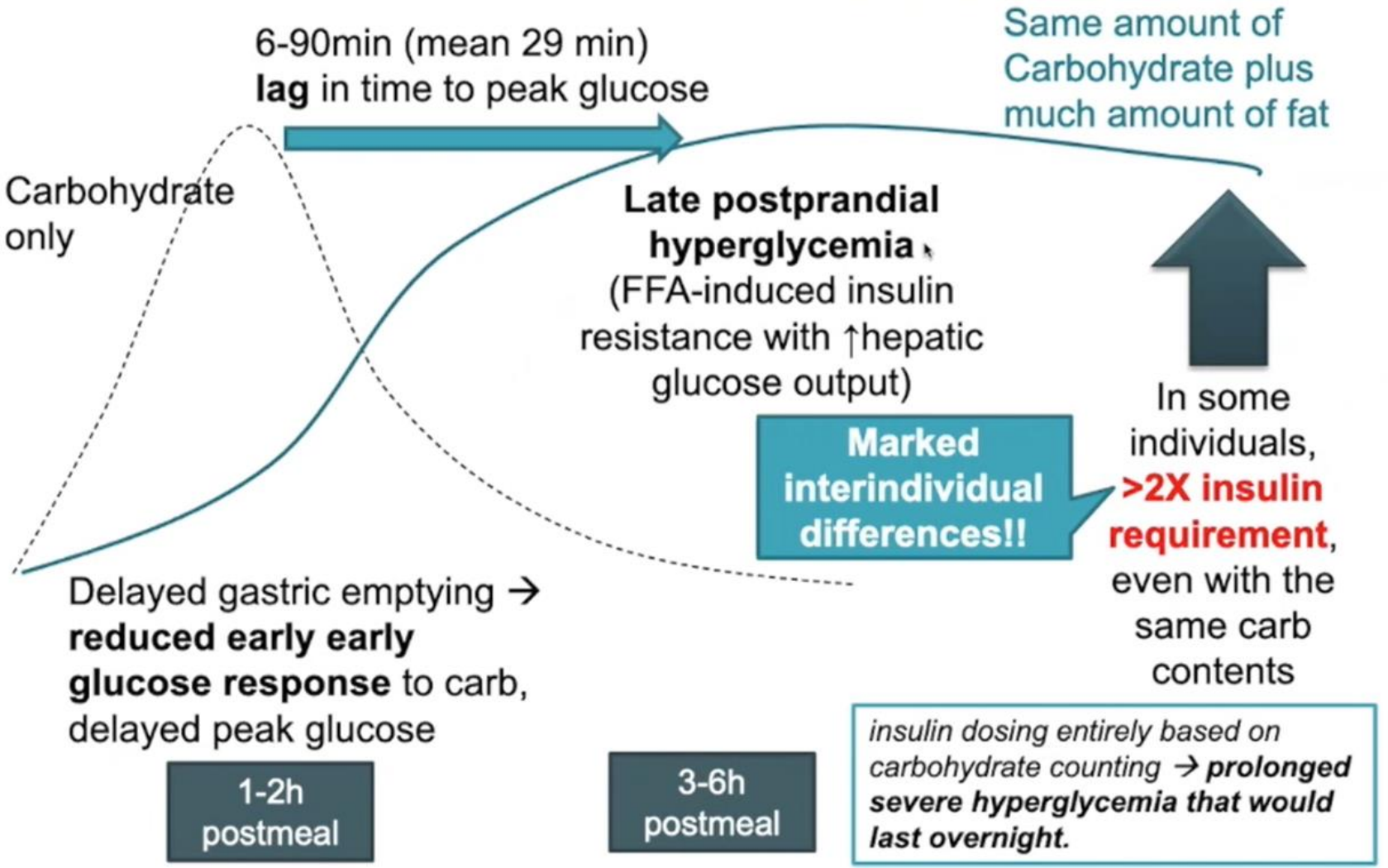


1:05 AM Fast-Acting 5 units	9:18 AM Low	9:58 AM Low	10:28 AM Low	3:24 PM Fast-Acting 7 units	6:19 PM Fast-Acting 6 units
10:08 PM Fast-Acting 4 units					

日期 Date: 22 Aug	早餐前 Pre-B	早餐後2小時 Post-B	午餐前 Pre-L	午餐後2小時 Post-L	晚餐前 Pre-D	晚餐後2小時 Post-D	睡前 Before S
血糖值 BG reading	時間: 08:30 度數: 5	時間: 11:30 度數: 6.7	時間: 17:35 度數: 10.3	時間: : 度數:	時間: 19:10 度數: 4.3	時間: 21:10 度數: 8.2	時間: 02:37 度數: 6.5
胰島素 Insulin	時間: 09:30 度數: 8	時間: 17:35 度數: 5	時間: 19:10 度數: 10	時間: 02:37 度數: 5改8			
主餐食物記錄 Meal Record	時間: 09:30	時間: 17:35	時間: 19:10	時間: :			
小食記錄 Snack Record	時間: :	時間: :	時間: :	時間: :			
運動 Exercise	時間: :	時間: :	時間: :	時間: :			

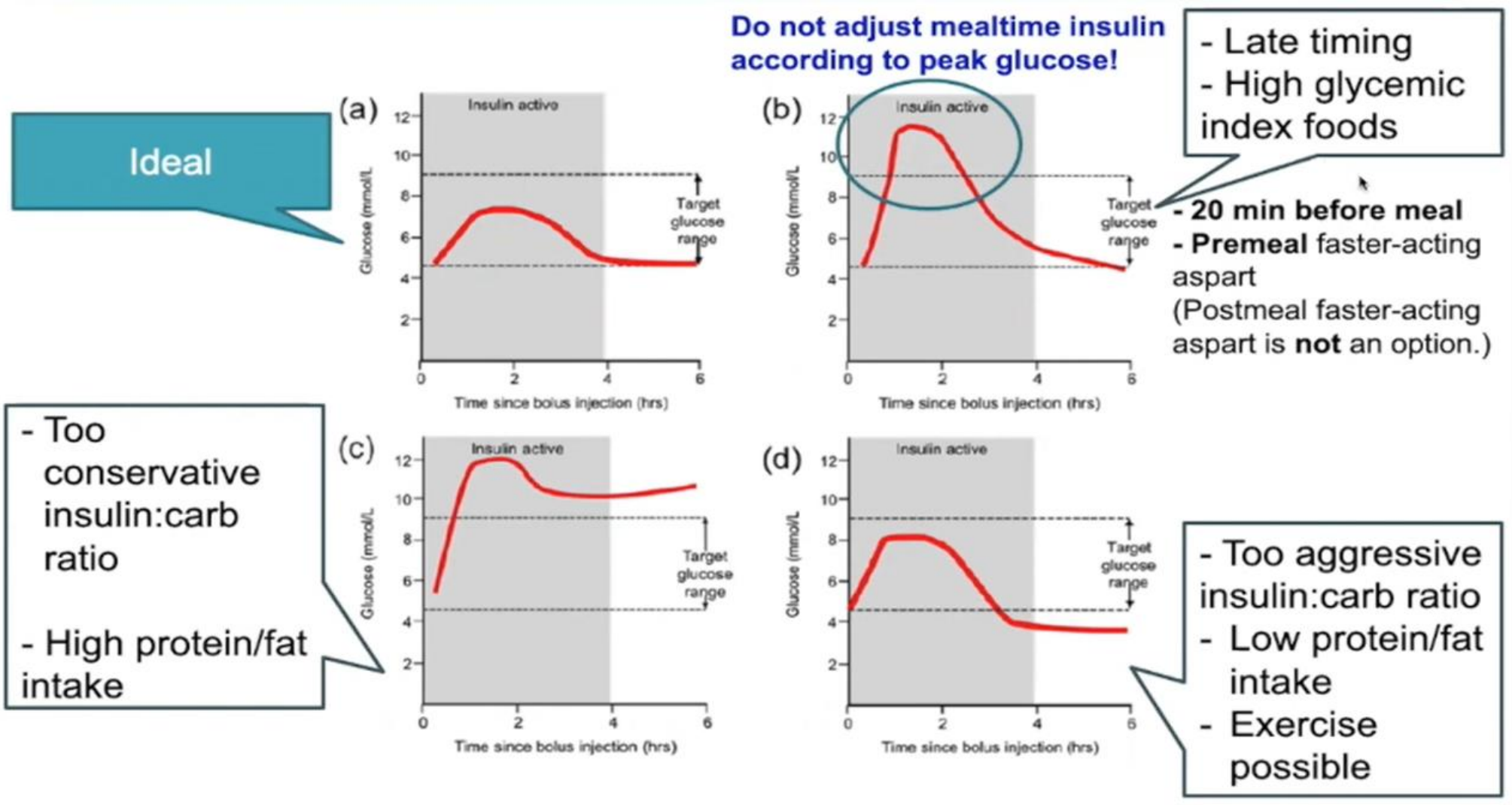
日期 Date: 21 Aug	早餐前 Pre-B	早餐後2小時 Post-B	午餐前 Pre-L	午餐後2小時 Post-L	晚餐前 Pre-D	晚餐後2小時 Post-D	睡前 Before S
血糖值 BG reading	時間: 10:30 度數: 3.3	時間: 12:30 度數: 10.4	時間: 13:20 度數: 9.9	時間: 15:30 度數: 6	時間: 22:20 度數: 4.8	時間: 00:20 度數: 14.1	時間: 00:25 度數: 9.1
胰島素 Insulin	時間: 10:30 度數: 氣打	時間: 13:20 度數: 8	時間: 22:20 度數: 4	時間: 00:23 度數: 10			
主餐食物記錄 Meal Record	時間: 10:30	時間: 13:20	時間: 22:20	時間: :			
小食記錄 Snack Record	時間: :	時間: 15:30	時間: 00:22	時間: :			
運動 Exercise	時間: :	時間: :	時間: :	時間: :			

Impact of fat on postprandial glucose excursion



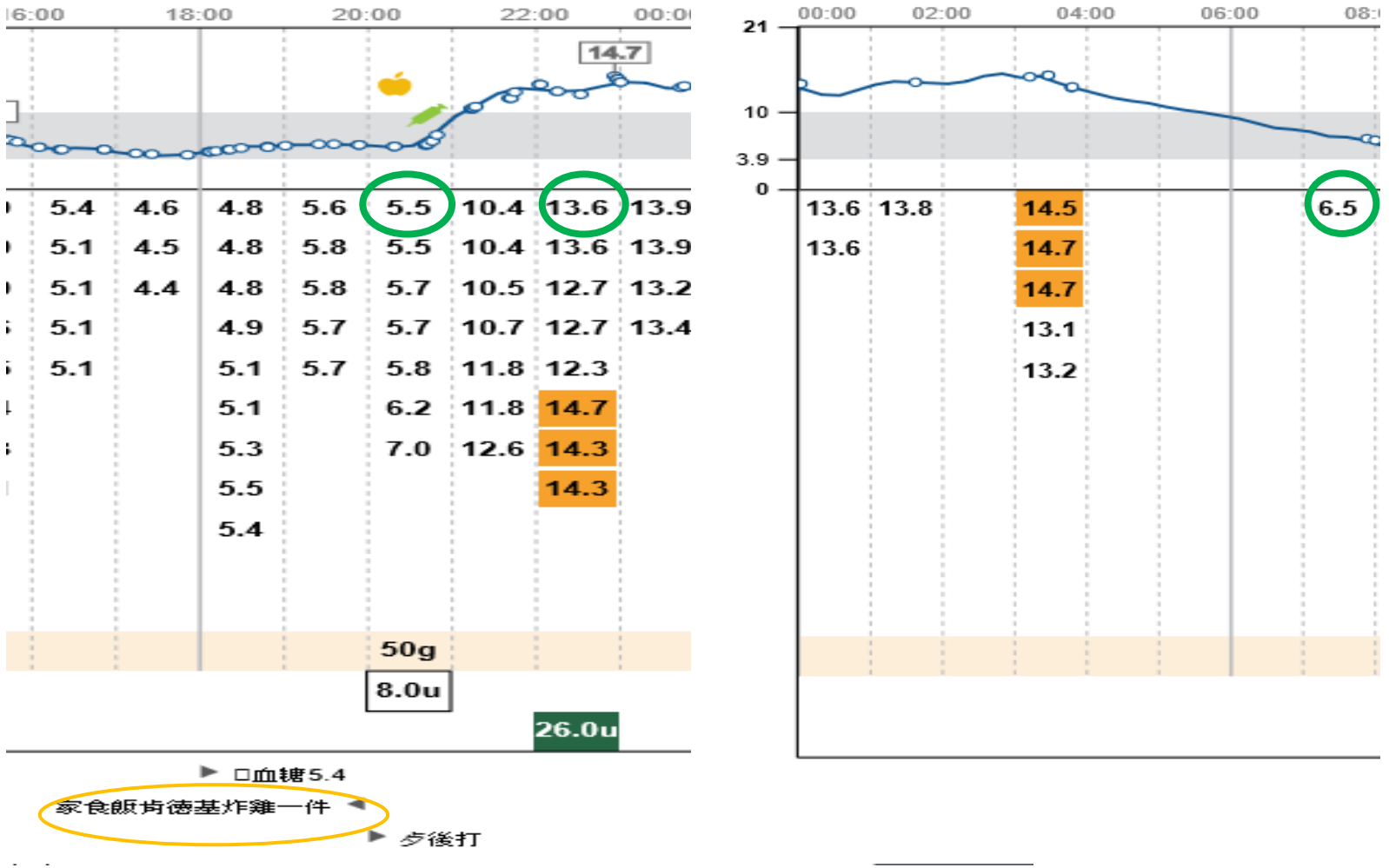
Diabetes Care 2015;38,1008-1015.

Steep postprandial glucose

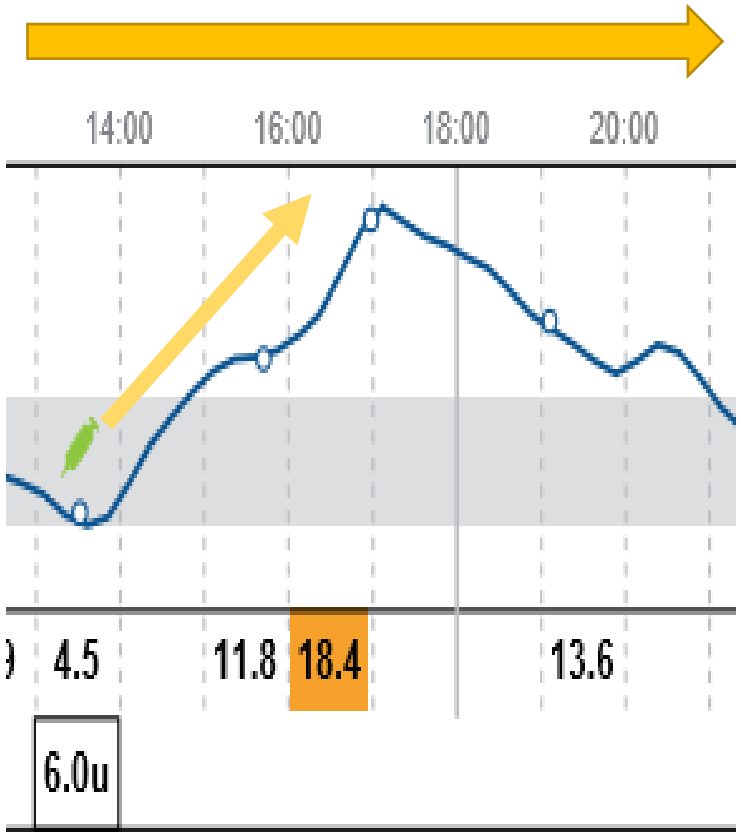


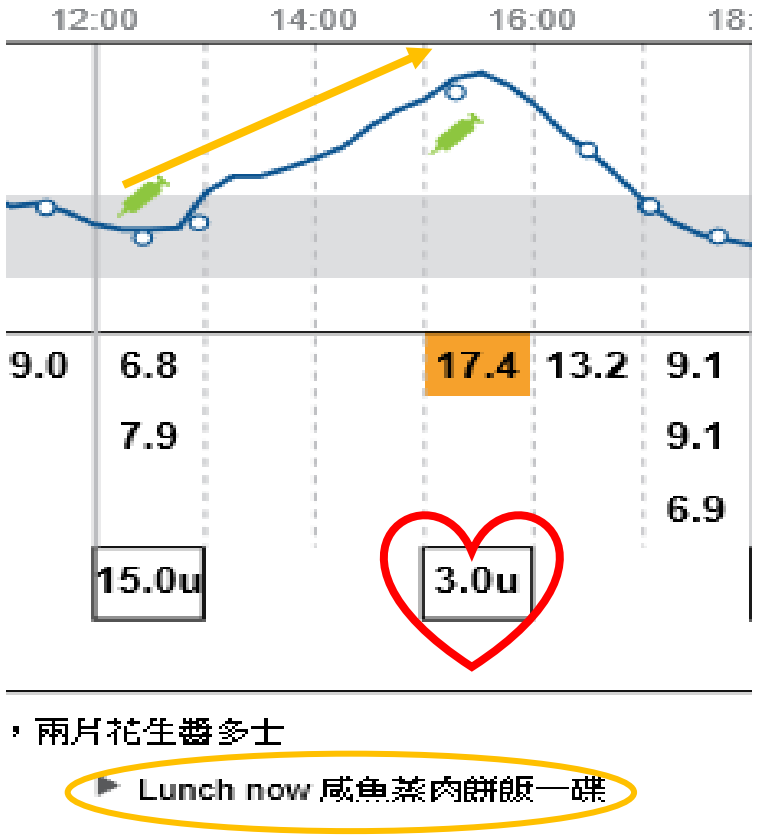
Diabetes & Vascular Disease Research 2019, Vol. 16(1) 3–12

High fat food (↑SG up to 10hs and peak of SG at 4hrs)

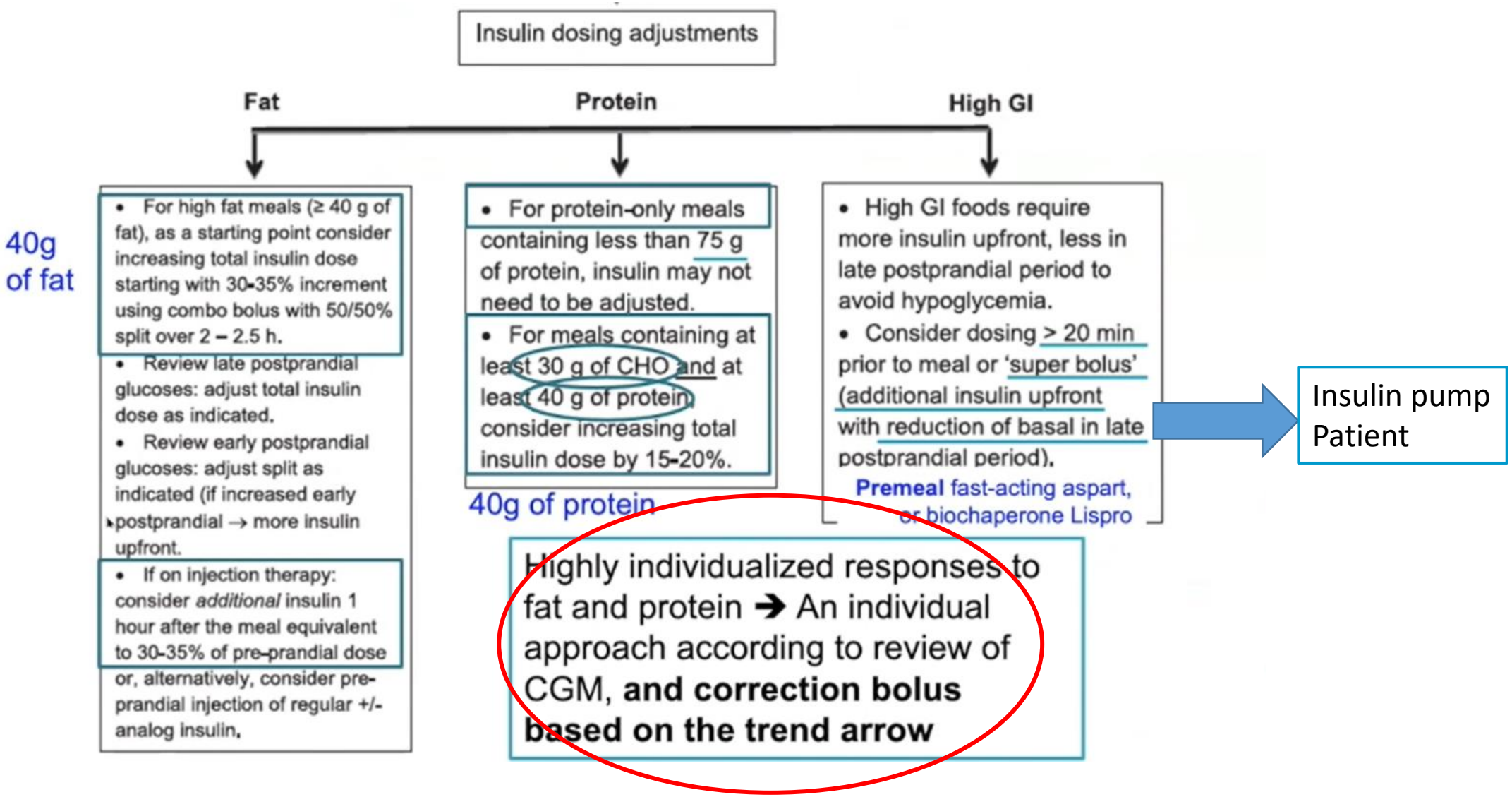


High fat food (Peak of SG at 4hrs)





Impact of fat, protein and glycemic index



Diabetes Care 2015;38,1008-1015.

Importance message

1. CGM >> an empowerment tool
2. Healthy and balance diet principle >> most important for risk factor control
3. Better use for alert and trend arrow > hypoglycemia prevention & healthy lifestyle modification
4. Guidance of treatment modality
5. Appropriate bolus dose adjustment for special situations


THANK
YOU